ELECTRICAL TIMES

THURSDAY
30 NOV.
1950
SIXPENCE

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GROUP 24

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Robust cast-iron construction throughout with detachable plinth and roof.

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One-piece insulating right-angle type shields acting as phase barriers and vertical front shields for busbars.

Four sizes of Units are available, 200 to 1,000 amp, suitable for 3-phase 4-wire systems with cartridge fuse-link protection up to 60 amp for fifth core, if required. Units for other systems can be supplied.

One-piece insulators with specially designed entry to facilitate insertion or removal of conductor fittings.

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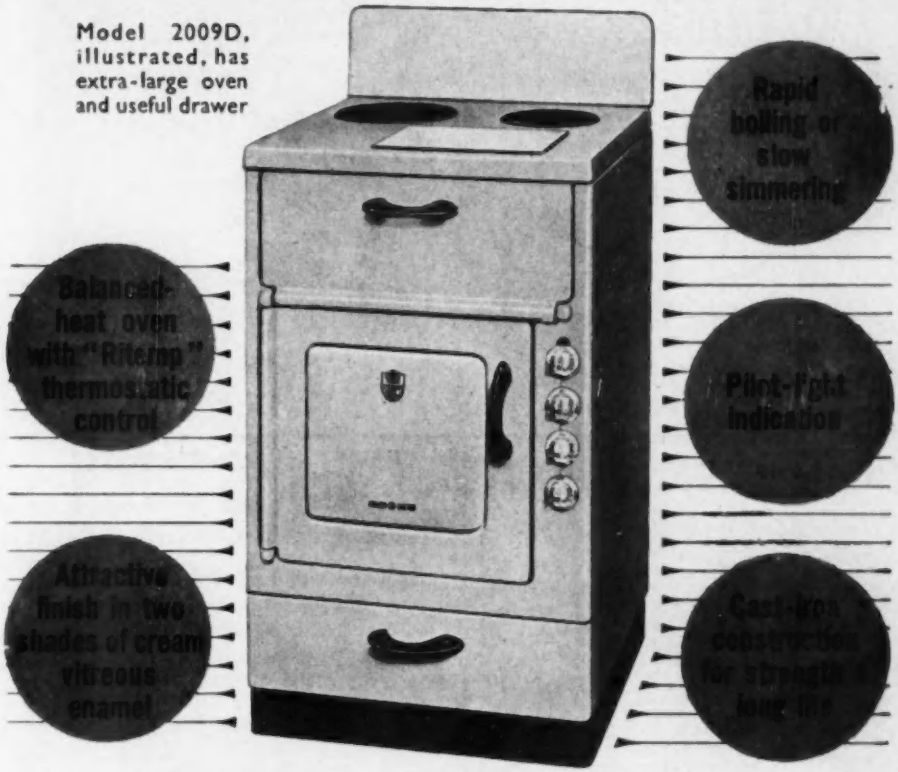
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Attractive finish in two shades of cream vitreous enamel
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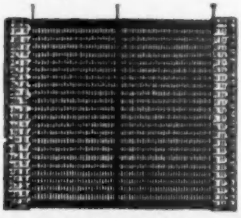

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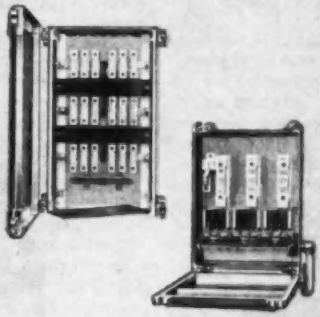

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1912-1950

The Story of BELLING *& Co. Ltd.* No. 18

IN THE LAST CHAPTER I dealt with our activities during the war and reached the end of 1945.

In 1946 I see that we were concentrating on changing back to our own products and simultaneously we were working hard on the standardised "V" Cooker for housing estates. In this year also we had an entirely new Baby Cooker, List No. 45, in production, which we have been turning out like hot cakes ever since. It is very interesting to see them coming off the production belt at the rate of one every two minutes, and we are at last just slowly catching up with the demand.

It was also interesting during this year to meet our various employees as they were gradually returning from the Forces, and it was very good to know that many of them reached very high ranks indeed.

There was also, as a matter of fact, one other rather special case of a lady who had served in the Timber Corps during the war, and from which, when she was eventually demobbed, she joined our firm by becoming my wife. We had a quiet wedding and everything has run smoothly ever since. The only trouble so far has been that she insists on trying out at home every new appliance we produce and does her level best to find every possible fault with them. This, however, is really of immense value.

1947. This year we made special efforts to increase our Export business by sending two of our Senior Staff to Canada, United States, Central America and South America. By the end of the year we had agents appointed in practically every country in the world, and we produced special log fires and log units for sale in different quarters.

The sale of fires in the home market was limited this year by the allocation of permits, with the object of reducing the general load as much as possible, as the supply of electricity was not too good and cuts were having to be made in various districts, which everyone remembers.

1948. This year we increased production of our cookers for the home market, and fires and cookers for the Export market. In connection with the latter we had to put up a new packing bay so that our large Export cases were packed under cover and under the best conditions. This is a fine building and we have a very attractive Neon sign stretching along the front of it and which is illustrated above.

Also during recent years we have made great improvements in the general mechanisation of the Works. Overhead conveyors, mechanical handlers, petrol haulage trucks, conveyorised tunnel ovens, water washed spray booths, moving assembly belts, new 500-ton presses, and complete reorganisation of our pottery section are just a few of the improved methods of production we have introduced.

1949. This year, owing to our still increasing Export, we were granted a licence to put up a further big extension, which was started on in this year and is now near completion—in fact, we have commenced moving machinery, and so on, over to it. This new extension is the biggest we have built up to the present time in one go and will give us an extra 50,000 sq ft. We have to move several sections from our present Works completely over to the new Works, which will enable us to extend the space for the sections which will be left. We shall begin to feel the benefit of this extension early in 1951.

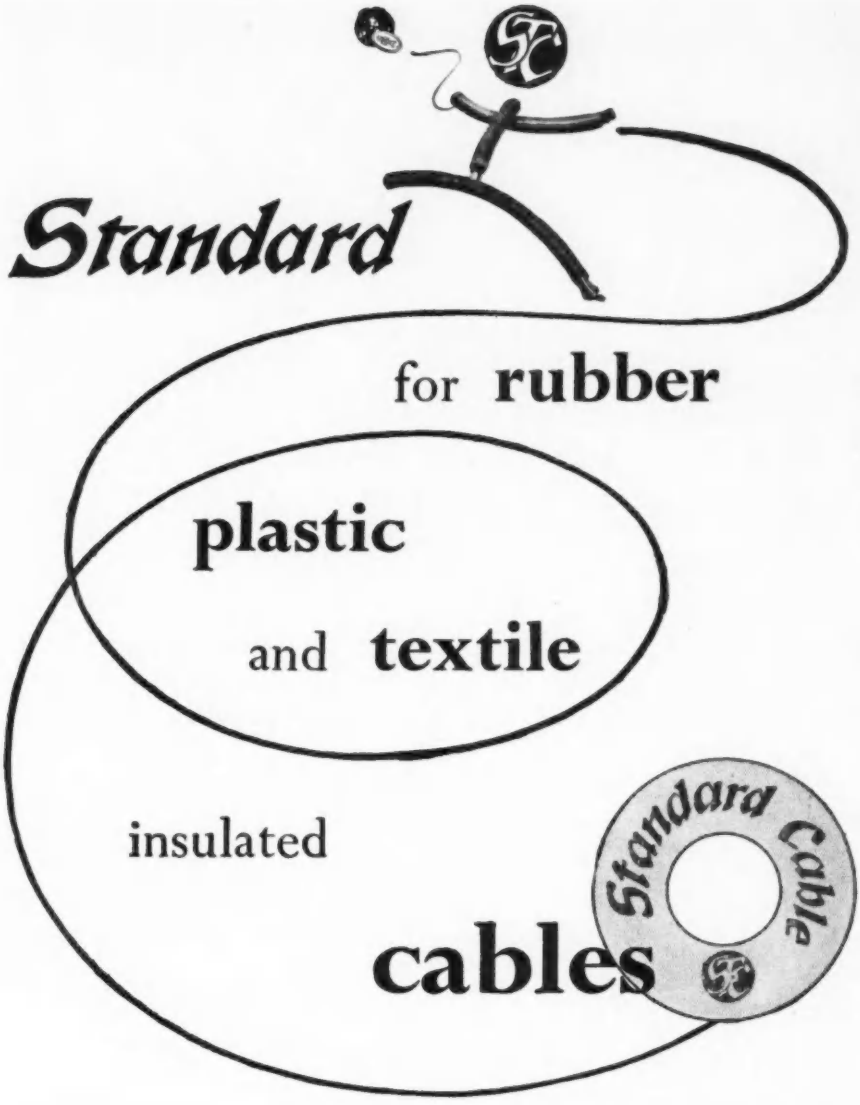
Incidentally, the tunnel kiln for our fireclay parts we are putting up in this extension will be one of the largest in the Electrical Industry.

The next chapter, No. 19, will deal with further improvements made during the years 1949-50.

C. R. Belling

Belling & Co., Ltd., Bridge Works, Enfield, Middx. Tel.: Howard 1212.

CRC 18



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ELECTRIC CONSTRUCTION BOOSTS GAS AT BIRMINGHAM

The illustration is reproduced by permission of
WEST MIDLANDS GAS BOARD
J. E. WAKEFORD, Esq.
M.B.E., M.Inst.Gas E., M.Inst.F.
Divisional Manager.

This Electric Construction motor driving a booster at the Washwood Heath plant of the West Midland Gas Board (Birmingham District) is a 460 B.H.P. fully compensated D.C. machine with a speed range of 750/1750 R.P.M. It is pressure-ventilated from separate motor-driven fans.
The control gear for this motor and the rectifier which supplies it are of E.C.C. make.

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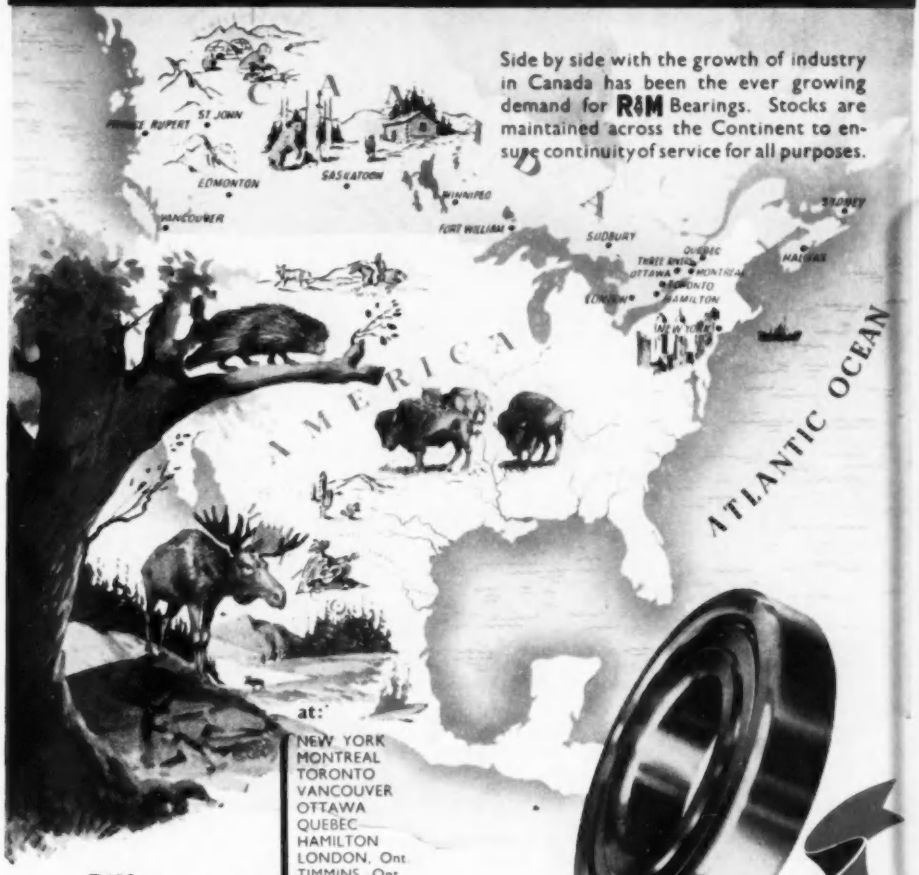
ACROSS THE ROLLING PRAIRIE



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CLYDE AND
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METROPOLITAN
CABLES
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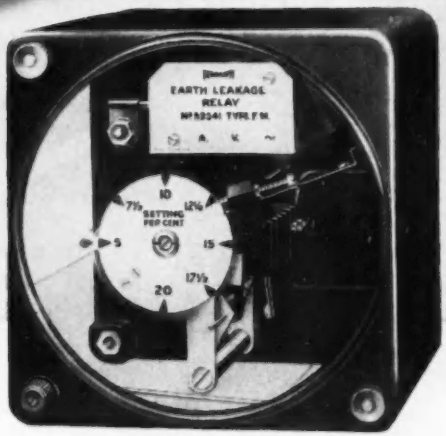

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Balanced armature in jewelled bearings ensures great sensitivity.

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One, two or three pairs of independent contacts can be fitted, to close or to open circuit.

Continuously variable settings.

Moulded case of pleasing appearance.

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Please write for List IR.6 giving full particulars.

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OVEN THERMOSTATS

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A method of testing as advocated by Government Departments

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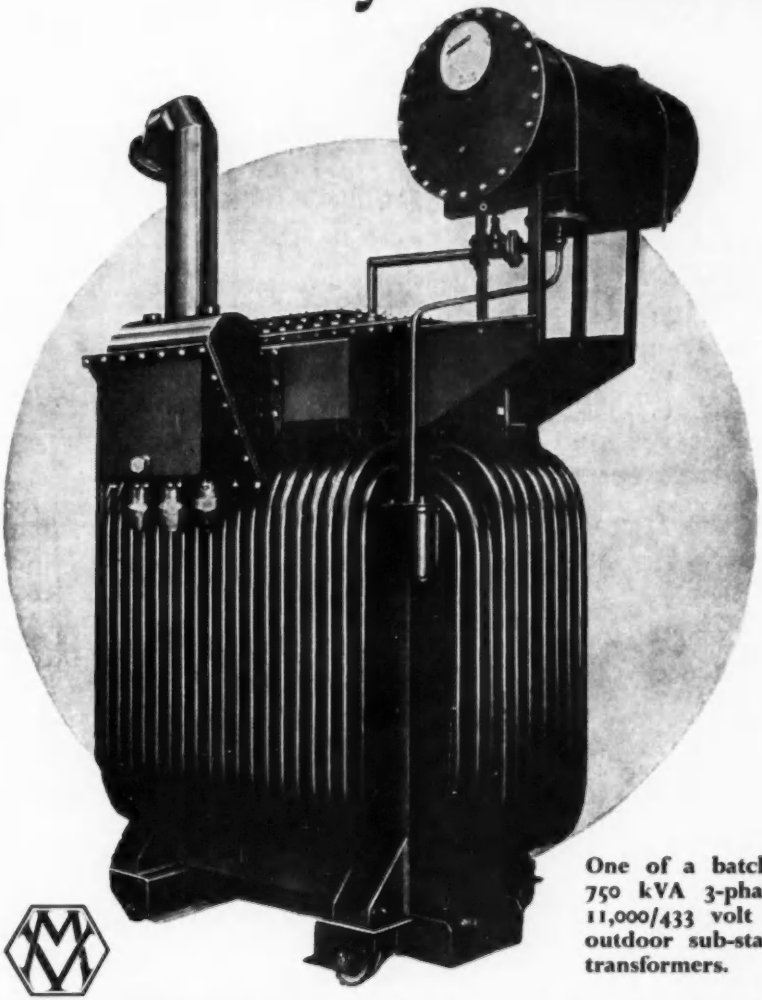
Manufactured under Licence from Ministry of Supply.

Sub-station Transformers by METROVICK



One of a batch of 750 kVA 3-phase 11,000/433 volt outdoor sub-station transformers.

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BRIGHTRAY C is for electric fires, cookers, etc. (maximum operating temperature 1,150° C.)

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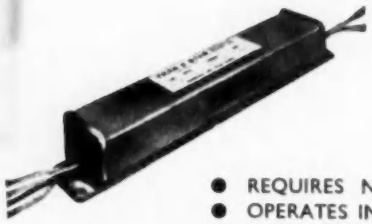

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NEW cooker control unit

Simplex now introduce a new seamless steel encased cooker control unit 30 amp D.P. Slow Break (Cat. No. 3802)
The new unit is for A.C. only and includes an auxiliary circuit for a kettle 3-pin 13 amp BSS 1363 Shuttered Socket. This cooker control unit is also available with an alternative auxiliary circuit—a 3-pin 15 amp interlocked BSS 546 plug controlled by Slow Break Switch (Cat. No. 3803) shown above
Standard finish is cream enamel, but white or grey mottle finish available on request
The simple and clean lines of this cooker control unit are in perfect keeping with the most popular British electric cooker — the Creda

MADE BY THE HOUSE OF **Simplex**

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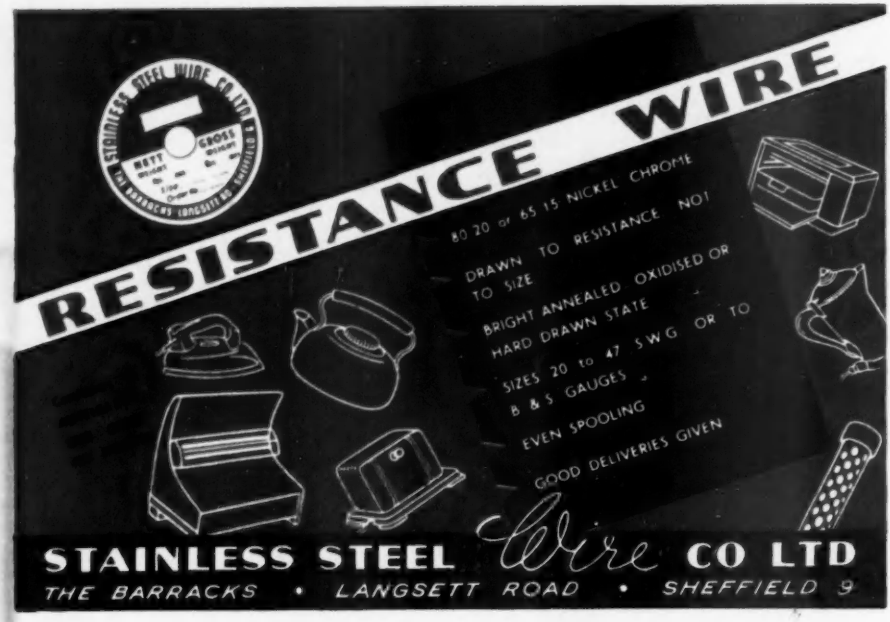
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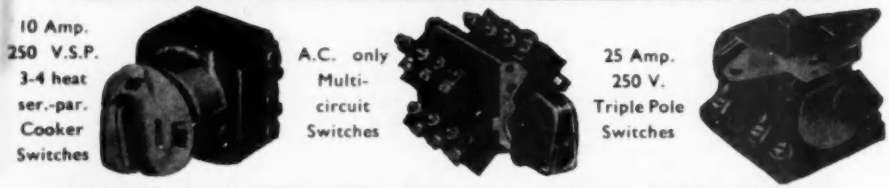

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"Shrinkage is the contraction of the molten metal upon solidification in the mould and may take place either externally or internally."

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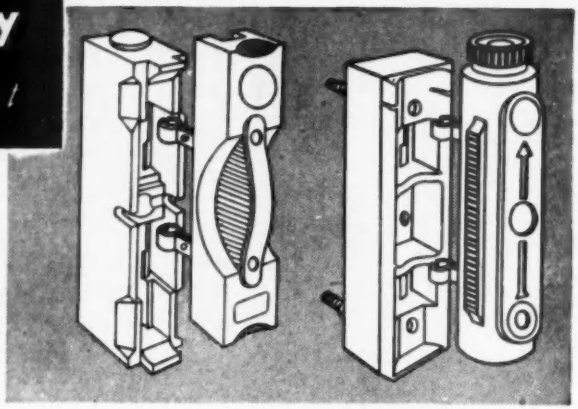
Unequalled efficiencies, both mechanically and electrically, keep SLYDLOK ahead whether vibration is a factor or not, this being equally true of either type.

Write for fully informative literature.



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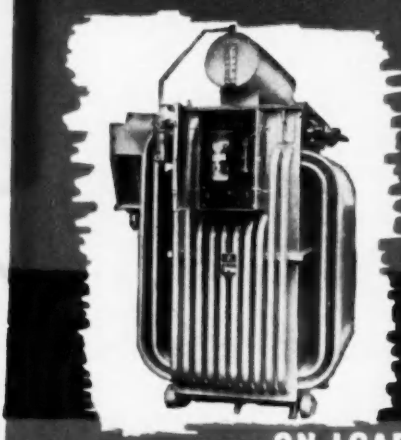

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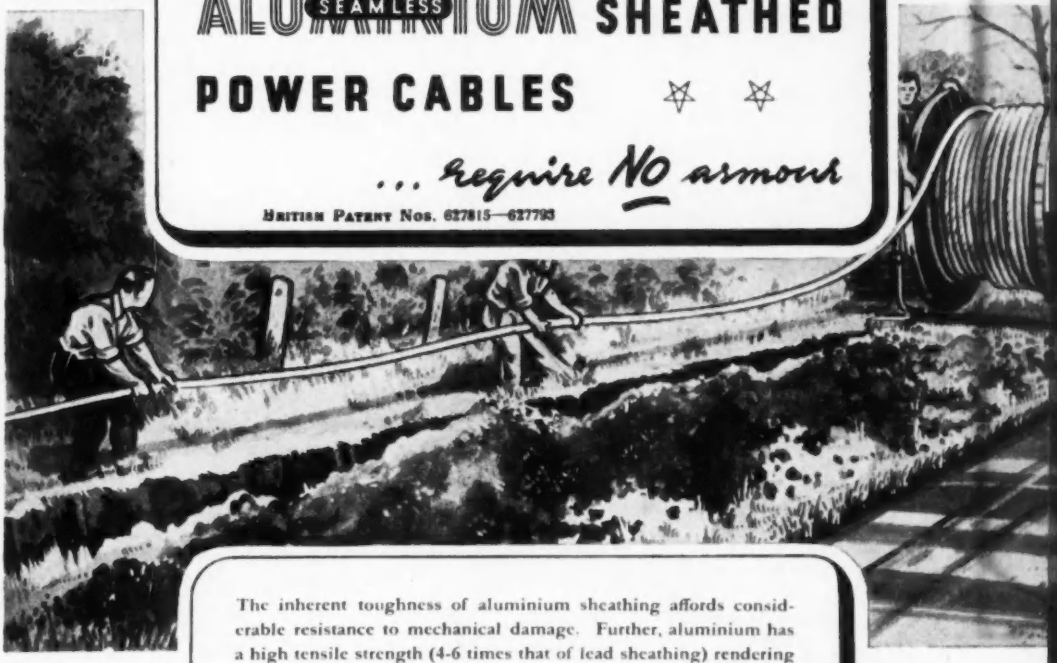
ALUMINIUM (SEAMLESS) SHEATHED POWER CABLES

... require NO armour

BRITISH PATENT NOS. 627815—627793



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Another

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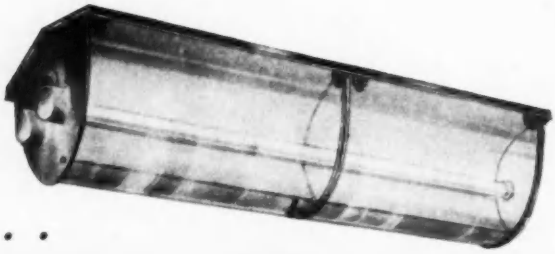

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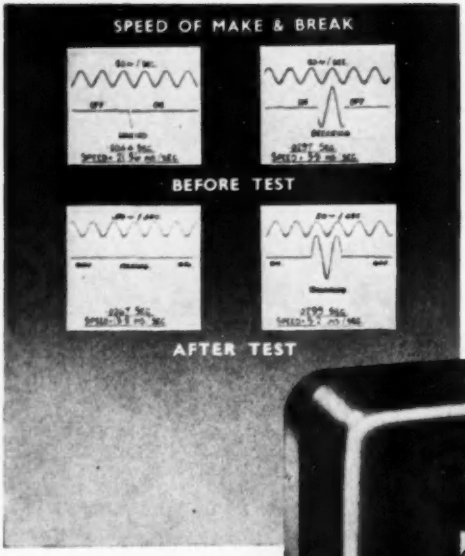

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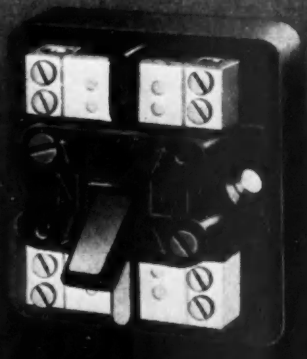

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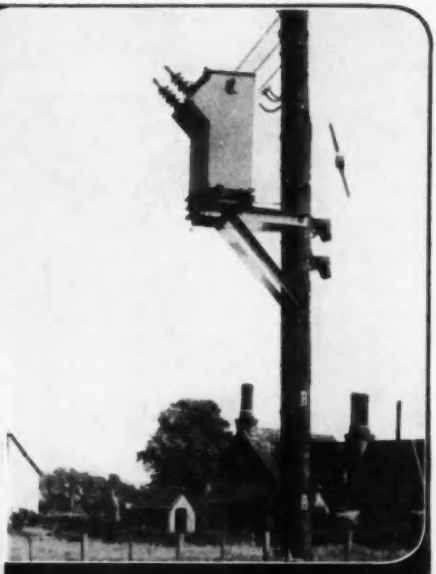

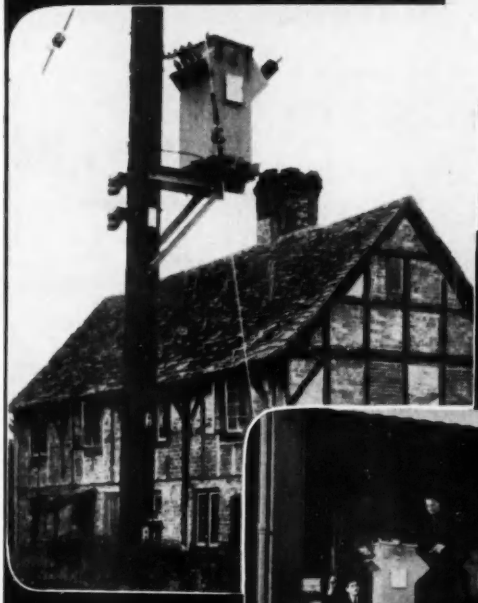

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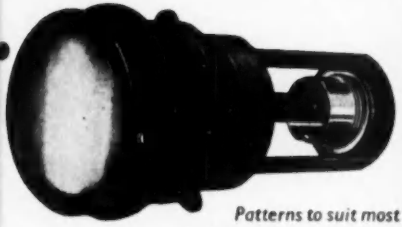

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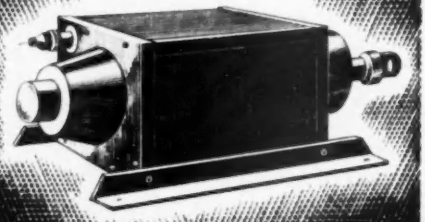

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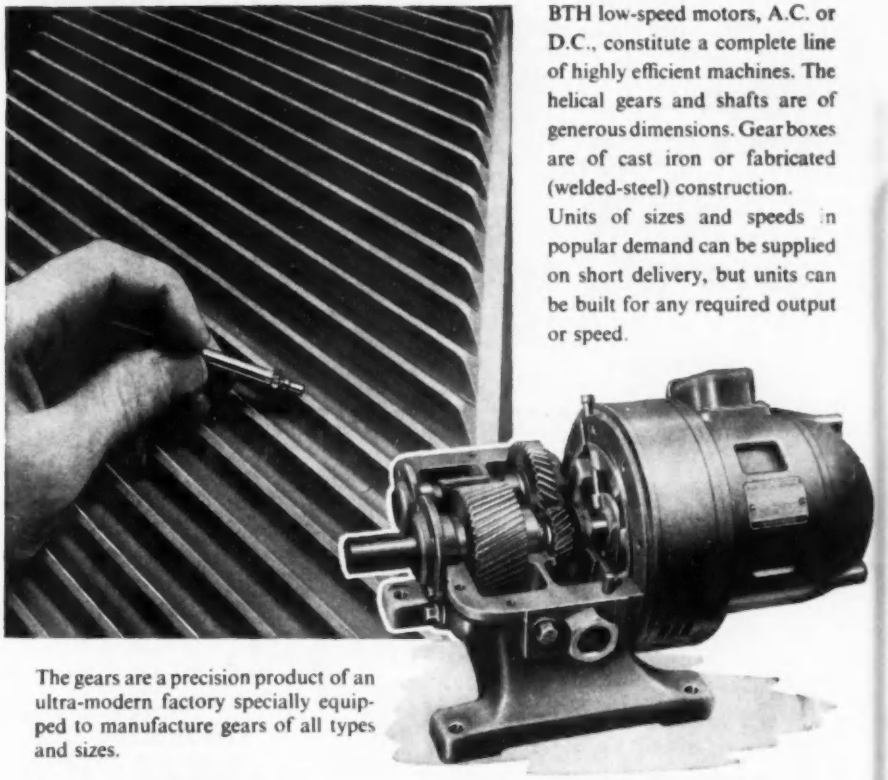

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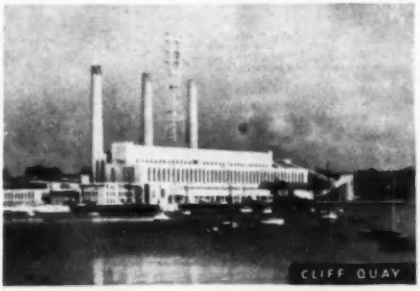

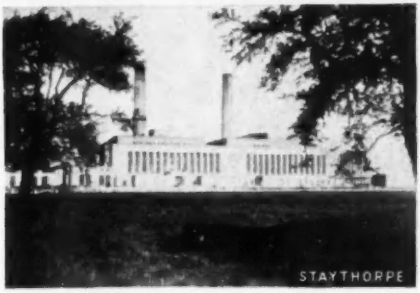

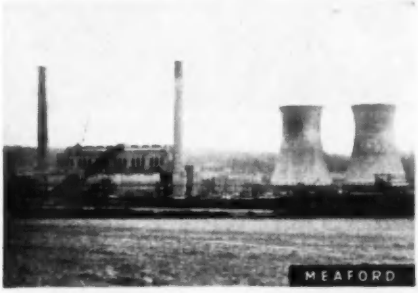

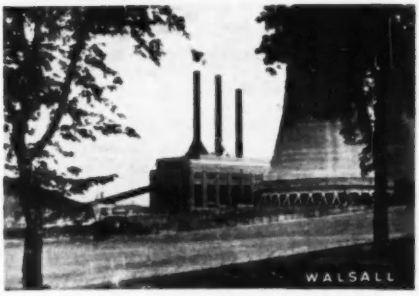

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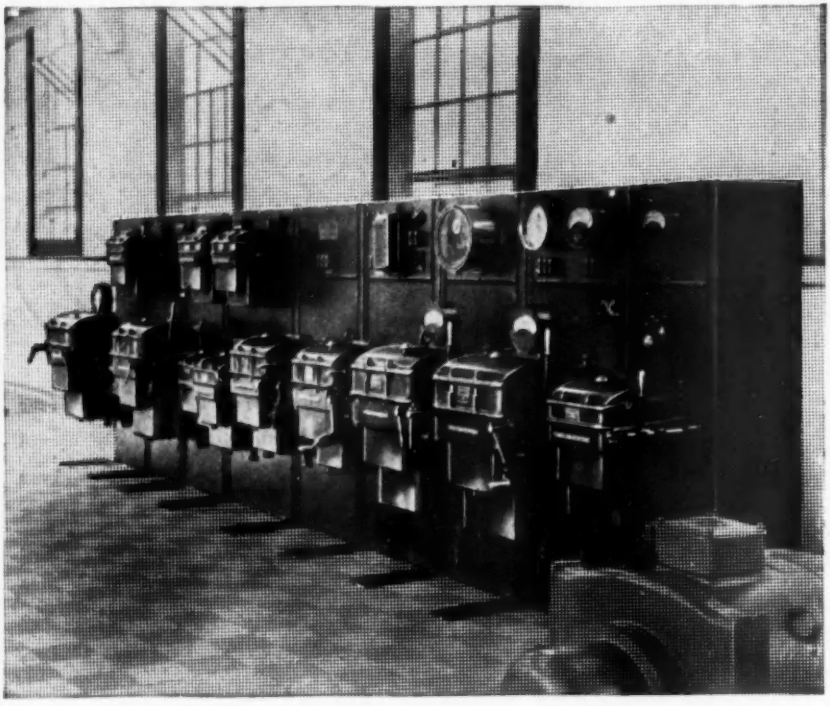

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ELECTRICAL TIMES

Vol. 118 No. 3082 THURSDAY, 30 NOVEMBER, 1950

PUBLISHED EVERY THURSDAY

SIXTIETH YEAR OF PUBLICATION

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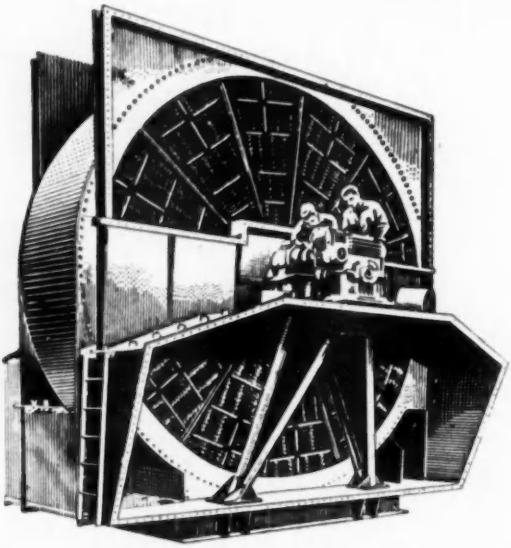

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Editorial

FORGOTTEN MAN

AS recorded elsewhere in this issue, next week brings the centenary of the death of William Sturgeon, a pioneer whose allocated instrument in the orchestra of Fame would appear to be the second fiddle. Overshadowed by his great contemporaries, Sturgeon is, in many text-books, dismissed in a couple of lines which credit him with the invention of the first electromagnet. It is perfectly true that Sturgeon was not a great scientist in the same way as was Faraday, for example, yet had Faraday's classic theory of the relationship between electricity and magnetism been delayed for another few months, there is good evidence to suggest that to Sturgeon might have gone the credit for the discovery. His role in the world of electromagnetic research would seem to be parallel to that performed by James Watt with the steam-engine. As a practical man of the period, translating the generalisations of others into practical realities, he had no equal. He built the first electromagnetic machine to produce any appreciable power, founded the Electrical Society which, had it not succumbed to financial stringency, would undoubtedly have been the forerunner of the I.E.E., and published the first electrical periodical, the "Annals of Electricity." More of an electrical engineer than a pure scientist, one feels that it would be fitting for electrical engineers to recognise more clearly his claim to remembrance. Faraday, Watt, Ampere, Ohm, Volta, Henry, Joule, Kelvin—all have given their names to units. Why not Sturgeon?

A TARIFF FOR FARMS

NOWADAYS one hears so much talk of rural development and favourable farm tariffs that we cannot but offer our congratulations to the South West Scotland Board on extending their domestic tariff to cover all farmhouses within their area. Particularly is this so, since their charges are most reasonable under present conditions. Tariffs for actual farms have also been standardised, and although the single step rate for lighting appears out of proportion to the rest of the tariff, in all, there can be little cause for complaint. In considering these favourable charges it will be remembered that the area includes the heavy industrial district of Glasgow, but on the other hand the overall density of population is far from high: only three other area boards have lower densities. The real factors determining the new tariff are the moderate fuel cost surcharge combined with the low operating costs of the Board. A single step rate at 4d. a unit for the first ten units per room is rare in rural areas, and there will be many urban consumers in the South of England envying the farmers of South West Scotland.

MUNICIPALISATION?

DURING the past two years little has been heard of the National Municipal Electricity Consumers Association, that phoenix which at vesting day arose out of the ashes of the former Committee of Smaller Municipal Undertakings. Now there has begun a flutter of wings and last week at a meeting with Members of Parliament, the Association put forward its views on reform of the supply industry. Its principal criticism, that of the present inadequacy of consumer representation, is one which is frequently expressed, but the censure of consultative councils as mere debating societies is a little hard, par-

ticularly in view of the recent action by the Eastern Council. The remedy put forward by the Association is, however, hardly one we can endorse. It is proposed that district committees should be set up to whom should be delegated certain of the executive powers now exercised by area boards, including limited power over finance. Thus, in effect, the proposal visualises a setting up of a quasi-municipal organisation to work in parallel with the present national constitution. Unquestionably, increased authority at district level is a desirable step, but what the B.E.A. needs is less committees rather than more, fewer channels of communication rather than the grafting on of another parallel path. We appreciate the strong municipal conscience which exists in this Association, but this should not blind them to the fact that any partial return to a municipal type of control would be a clumsy way of resolving any doubts they may have on the form of present consumer representation.

STANDARDISATION OF TURBO-ALTERNATORS

STANDARDISATION is always a vexed subject. Its protagonists point to the economies to be achieved and the ease of replacements, and its opponents emphasise the inevitable drag that standardisation will place on development and progress. In the past a compromise has generally been reached—usually not completely satisfying to either side. A case in point is the standardisation of large turbo-alternators as laid down originally in S.R. and O. 2386 of 1947. Now further weight has been added to the anti-standardisation side by the discussion following Mr. Robinson's paper to the Institution of Mechanical Engineers, reported elsewhere, in which the general consensus of opinion was to accept standardisation of valves, pipes, connections and gauges, but leave the machine itself alone. After all, most turbine manufacturers standardise as far as possible within their own works, and providing the B.E.A. specifies consistent steam conditions, standard conditions will automatically apply without the need for the issue of any comprehensive standards, and technical development could also take place unhampered by any artificial barriers.

DODOCONCENTRIC

EARTHED concentric wiring, to the average engineer, is as dead as the dodo—a semi-mythical system of which but few have had experience. Handicapped as it was by the regulations prohibiting direct connection to public supplies, few of the younger generation of wiremen can ever have heard of it, save in the earlier editions of standard text books, in lecture notes, and on the "wiring system" specimen boards which still linger in the forgotten lumber-rooms of the less ruthless technical schools. It seems possible that with the aid of mineral insulated copper-sheathed cable it may be due for a re-birth, however. In the last five years, two or three large industrial installations have used it for single-phase lighting distribution, and it seems more than likely that the fashion will spread.

INDUSTRIAL ONLY

ON LARGE industrial installations, earthed concentric wiring of this type can offer marked economies, since not only is twin cable replaced by single-core, but, due to the sheath section being in many instances larger than the actual core section, voltage drop is actually reduced, thus increasing the permissible rating of the circuit. Against this advantage, of course, must be balanced the need for special fittings, and the necessity of ensuring perfect joints in the sheath. While the cost of special fittings should not be a deterrent on large installations, for which they would be specially ordered anyway, it would be a stumbling block on small jobs. Since it is also prohibited by I.E.E. regulations from direct connection to public supplies, except in the case of multiple-earthed neutral systems, we can foresee little future for domestic usage, either.

Meteor

Separation of Leakage Reactance in Two-Winding Transformers

Methods of associating the leaking components with each winding are surveyed by the author

By K. GOLDSMITH, M.Sc. (Eng.), A.M.I.E.E.

THE leakage reactance of a transformer is dependent on its leakage inductance which, for a two-winding transformer, is commonly defined as the flux per unit current produced by either winding and not linking the other winding, or, in approximate terms, as the difference between the self-inductances of both windings and their mutual inductances. The existence of leakage flux thus necessitates the presence of both windings, and the leakage is a fixed quantity for any given transformer of fixed dimensions. Since each winding contributes to the total leakage flux, a leakage component can be associated with each winding. These leakage components largely determine the performance of the transformer as a system impedance when on short-circuit or under heavy load, and it may be important, therefore, to estimate the leakage component of each winding separately.

Equivalent Circuits

A simple way of representing the circuit parameters of a two-winding transformer is shown in Fig. 1a, where R_p and R_s are the primary and secondary winding resistances, Z_p and Z_s the admittances of the primary and secondary magnetising branches and X_L the leakage reactance common to both windings. This circuit is equivalent to the more usual circuit of Fig. 1b, in which Z_p and Z_s are replaced by the common magnetising branch Z_M and X_L is resolved into its primary and secondary components X_p and X_s. The second circuit is perhaps physically the more correct; it signifies that leakage inductances, or reactances, are, like winding resistances, or copper losses, associated with a particular winding, and that the magnetising branches form in effect a mutual reactance determining the flux, and hence the energy, transfer from one winding to the other. But it is clear that leakage cannot exist without the presence of both windings, and it is very difficult, therefore, to determine the leakage inductances separately for each winding.

Leakage Fluxes

The flux set up by an energised transformer winding is divided into two parts, the bulk consisting of the useful flux linking both windings, and the remainder of the leakage flux linking one winding only. Most of the useful, or mutual, flux passes through the iron core, although a small proportion may exist outside the iron circuit. The leakage flux passes partly through iron, partly through copper and partly through air as is shown in Fig. 2. If, in a core-type transformer, the windings are on one of the outer legs, some of the leakage flux of the inner winding passes through the iron core, and some of that of the outer winding through the transformer tank and iron stray paths, such as bolts and clamping plates. With the windings on the centre leg, more leakage flux will pass

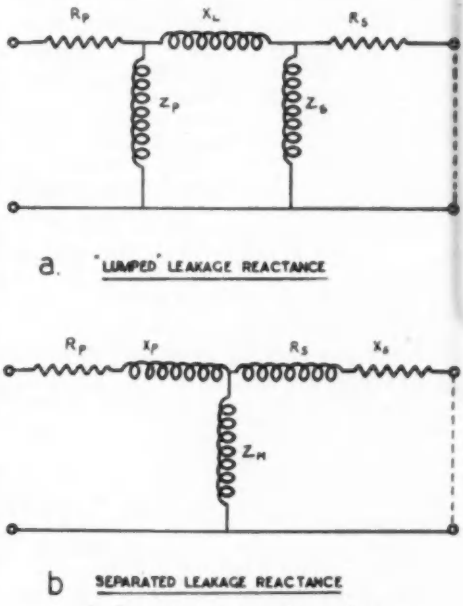

Fig. 1. Equivalent circuits of transformers

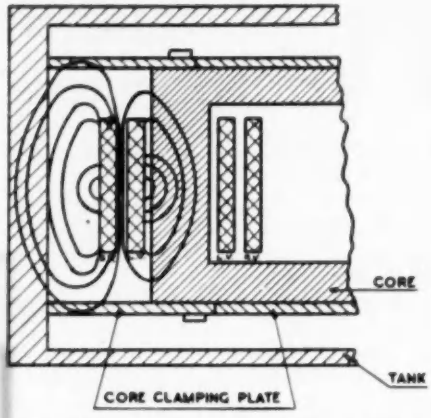

Fig. 2. Diagram showing leakage flux paths through iron and copper and air

through the outer legs, and less through iron stray paths. The amount of this "stray" leakage flux will be still smaller in shell-type transformers. The reluctances of the leakage flux paths associated with each winding will thus depend on the type and construction of the transformer, the overall reluctance being usually smaller for the inner winding.

The reluctances are, however, also affected by the loading of the transformer; this produces magnetic distortion, primarily a displacement of the primary flux by the secondary magnetising force, which reduces the mutual flux and thereby increases the leakage flux. Partial or complete saturation of some of the iron paths would also critically affect the reluctance of the leakage paths. Two difficulties thus arise if an attempt is made to separate the leakage inductances of a transformer into primary and secondary components:

1. Calculation of the separate leakage inductances from the constructional data of the transformer is extremely difficult and accurate calculation impossible owing to uncertainty as to the position of the reluctance paths.

2. Correlation of data obtained for a given transformer under no-load and full-load conditions, and thus computation of separate leakage inductances, is usually not possible, owing to the different state of magnetisation of the iron in the two cases.

Simple Circuit Calculations

It is frequently assumed that the equivalent terminal inductance of a transformer with the secondary winding on short-circuit is given by

$$L_e = L_1 + K^2L_2 - 2KM = l_1 + K^2l_2 \cdots (1)$$

where L_1 and L_2 are the primary and secondary winding inductances, M the mutual inductance between the two windings and K the primary to secondary turn ratio. It is assumed in equation (1) that $l_1 = L_1 - M$ and $l_2 = L_2 - M$, and that, in accordance with the discussion above, all measurements are carried out at sufficiently low currents to permit the permeability of the transformer iron to remain substantially constant.

According to equation (1), the total leakage inductance is equal to the equivalent short-circuit inductance, but, if this is to be correct, the admittance of the magnetising branch must be negligible compared with that of the short-circuited winding or, alternatively, the impedance of the latter must be very low. But, even if this is the case, it is necessary to know l_1/K^2l_2 as well as L_e before a separation of leakage inductance can be attempted. Although it is frequently assumed that $l_1/K^2l_2 = 1$, there is abundant experimental evidence that this is not normally the case even for concentric coils of equal axial length and symmetrical arrangement; the leakage inductance associated with the inner winding is usually the smaller.

Alternative Approach

A different method of approach is offered by computation of l_1 and l_2 from values of L_1, L_2 and M measured, say, on a suitable bridge. The principal difficulty in iron-cored transformers is that, apart from changes of self and mutual inductances with the loading of the transformer, these quantities are very large and $L_1 - M$ and $L_2 - M$ thus represent small differences of large quantities and are therefore difficult to determine accurately. The larger the transformer the greater will be the difficulty of computing the separate leakage inductances from measured self and mutual inductances.

In air-cored transformers, however, i.e. in a system of two coupled coils, this difficulty does not arise, and l_1 and l_2 can be found from measured values of L_1, L_2 and M to a reasonable degree of accuracy. An alternative method is to use Maxwell's equation for the total equivalent inductance of two coupled coils with a short-circuited secondary

$$L_e = L_1 - \frac{\omega^2 L_2 M^2}{R_2^2 + \omega^2 L_2^2} \quad (2)$$

where R_2 is the secondary resistance and $\omega = 2\pi f$. Any of the quantities in this equation can be found by measuring L_e at different

frequencies and thus obtaining a sufficient number of simultaneous equations. l_1 and l_2 can be calculated directly by substituting $l_1=L_1-M$ and $l_2=L_2-M$ in equation (2); this gives

$$L_e=l_1+M\,\frac{(R_2^2+\omega^2 l_2\,(l_2+M))}{R_2^2+\omega^2\,(l_2+M)^2} \quad (3)$$

The accuracy with which l_1 and l_2 can be found is brought out in Table 1 where the results obtained by different methods are compared, but even for this simple system of coils, only an approximate determination of the separate leakage inductances is possible since small discrepancies between the measured and calculated self and mutual inductances may lead to large discrepancies between the corresponding leakage inductances. Thus, a difference of 3% between M(A) and M(B) produces a difference of 24% between l_1(A) and l_1(B).

The data show, however, that, as pointed out above, l_1/l_2 for concentric coils of equal axial length is not unity, and that l_1/l_2 is usually larger than L_1/L_2 (e.g. for the data under A in Table 1, $l_1/l_2=2{\cdot}23$, $L_1/L_2=1{\cdot}085$), because L_1 and L_2 have a large common component. This latter point emphasises that the ratio of L_1/L_2 gives no indication of the relative magnitudes of l_1 and l_2.

Separation By Calculation

The leakage inductance of a core-type transformer increases with the number of turns and the gap between the coils, with the width of the coils and with decreasing coil length. It is possible to calculate the leakage inductance from the transformer dimensions, and thus to take account of the separate contribution of each winding to the total leakage inductance. Such calculations are, however, usually very complex and only an approximate value of the separate leakage inductances can be obtained for comparatively simple winding arrangements.

TABLE I

Separation of leakage inductances for two coupled coils

Inductances (micro-henries)	L_1	L_2	M	l_1	l_2	l_1+l_2
A. Values of L_1, L_2 and M measured ...	102	94	87·5	14·5	6·5	21
B. Values of L_1, L_2 and M calculated from equation (2)	101·2	97	90·2	11·0	6·8	17·8
C. Values of l_1 and l_2 calculated from equation (3)	—	—	—	9·9	7·8	17·7

Rogowski[1] has developed a correction factor which permits calculation of the effect of the iron core on the leakage inductances. These can thus be computed in the first instance on the assumption that the transformer is air-cored, and the resulting inductances can be corrected for the presence of the iron by multiplying with the Rogowski factor. Use of this factor is subject to many limitations; it is not valid, for instance, for transformers with unequal coil lengths, asymmetrical coil distribution and coils interrupted by tappings.

A different method has been put forward by Kapp[2], where the leakage inductances are calculated on the assumption of a simple flux distribution between the windings. Kapp's method is widely used for the calculation of the total leakage reactance (*vide* Ref. 3), but it also permits separate primary and secondary leakage coefficients to be obtained, the secondary coefficient being usually very small compared with the primary coefficient.

Neither method is entirely satisfactory under practical conditions, and it will usually be necessary to resort to experimental techniques.

Separation By Experiment

The two most common methods of measuring transformer leakage inductances are:

(a) Short-circuit tests, where one winding is energised and the other short-circuited.

(b) Back-to-back tests, where both windings are energised.

Both tests aim at eliminating the flux common to the two windings and measuring the remainder, which is the leakage flux. If it is desired to find the leakage component of each winding, it is usual to make assumptions as to the flux or voltage distribution between the two windings (i.e. by assuming $l_1/K^2l_2=1$). For unity-ratio transformers, results can be obtained by these methods, but they are by no means accurate. If the turn ratio is not unity, the inaccuracies are likely to be greater.

Several investigators have suggested experimental methods for resolving the leakage reactances into primary and secondary components. Boyajian[4] has described four methods for a two-winding transformer which are perhaps best known. In all of the methods, the mutual flux is eliminated by connecting the windings in parallel or in opposition (back-to-back test), and the distribution of the remaining leakage flux is found by measuring the corresponding voltages. But this is only possible if the magnetising forces exerted by each winding are equal. The four test circuits suggested by

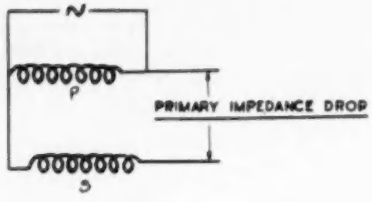

Fig. 3. Regulation due to exciting current

Boyajian are shown on this page. If the primary winding is energised by its exciting current and connected in series-opposition with the secondary winding (Fig. 3), the voltage between the two adjacent primary and secondary terminals is a measure of the primary impedance. The same test can be repeated for the secondary winding, and the ratio of the two terminal voltages will then be equal to the ratio of primary to secondary impedance. This test can only be used for unity-ratio transformers. Similarly, the division of the exciting currents with the two windings excited in parallel (Fig. 4) can be used as a measure of the leakage impedances; the currents will divide inversely to their respective leakage impedances. With the exciting voltage applied between the two adjacent primary and secondary terminals and both windings again connected in series-opposition (Fig. 5), the voltage across each winding will be dependent on the corresponding leakage impedance, and will thus denote the impedance distribution. For transformers where the turn ratio is not unity, a separate identical transformer is required to energise the secondary winding. This latter test is simplified to some extent if a current transformer is used to load the secondary winding. In the parallel impedance test (Fig. 6), the same result is achieved by connecting the two windings in parallel-opposition; the ratio of the leakage impedances is then given by the ratio of the respective winding currents. As in the previous test, a separate transformer can be used for turn ratios other than unity. The advantage of carrying out such tests with load currents rather than with exciting currents is that, in the former case, the state of magnetisation of the transformer core approaches that experienced under normal operating conditions, and the leakage reactances are therefore more representative of these conditions.

Separation method with 3-phase Transformers

A fifth method of separation proposed by Boyajian can be used for three-phase transformers. The relation between the distribution of exciting currents and leakage impedances for windings excited in parallel also applies approximately to higher harmonics of the exciting current. If, for instance, two delta-connected windings are connected in parallel, the division of the third harmonic exciting currents between them will be inversely dependent on the respective leakage impedances. In a more complex method developed for three-phase transformers by Dahl[5], use is made of the third harmonic currents passing through three identical and interconnected three-phase transformers. The method can be used for multi-winding transformers, but attempts to apply it to single-phase transformers have not met with success.

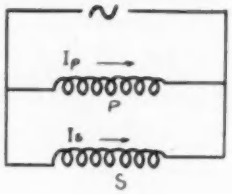

Fig. 4. Division of exciting current

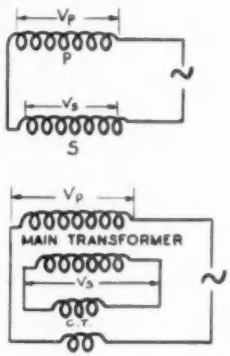

Fig. 5. Series-opposition test

Restriction of Application

All the methods for the experimental resolution of leakage reactance outlined above can be used in only two cases.

1. For unity-ratio transformers if a common source of supply is used for both windings.

2. For other transformers if at least two identical transformers, or suitable current transformers, are available with mains supplies of sufficient capacity to permit the loading of the low-voltage windings.

Transformers with split primary or secondary windings are an exception; these windings can

be connected in opposition and the leakage reactances can be separated by treating each winding as an independent unity-ratio transformer.

One difficulty common to all tests is the change of the reluctance of the mutual and the leakage flux paths with load current; this may introduce considerable errors in the computation of the separate leakage reactances. This change does not permit correlation of the results obtained by different methods of connection, unless the load conditions have been approximately the same in each case.

A New Method

It is clear from this discussion that separation of the leakage reactances of a given single- or three-phase transformer is not an easy matter, particularly if neither sufficient constructional data to permit approximate calculation nor sufficient experimental facilities, such as transformers for back-to-back tests, are available. It has been pointed out earlier that Maxwell's coupling equation can be used for air-cored transformers to compute l_1 and l_2 from values of L_e measured at different frequencies. Application of the same technique to iron-cored transformers is made more difficult because of their large self and mutual inductances and, in general, the considerably smaller change of L_e with frequency. Such a technique would, however, have such advantages over the methods outlined above that it appears worthy of more detailed consideration.

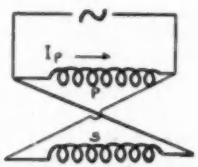

Fig. 6. Parallel impedance test

If, in Fig. 1b, X_p and X_s are replaced by the leakage inductances l_1 and l_2, and Z_M is resolved into its magnetising and loss components L_M and R_M, both connected in series, the equivalent short-circuit inductance L_e is given by

$$L_e = l_1 + \frac{L_M r_2^2 + l_2 R_M^2 + \omega^2 (l_2 L_M (l_2 + L_M))}{(r_2 + R_M)^2 + \omega^2 (l_2 + L_M)^2} \quad \ldots (4)$$

where all quantities are referred to the primary side.

Experiments have confirmed that, at frequencies below about 1,000 c/s, the variation of L_e with frequency is largely governed by this equation and that the other parameters in the equation, except ω, remain substantially constant. The fact that such a variation is possible, even in comparatively large transformers, proves that Z_M cannot be negligible and that equation (1) cannot be used. On the other hand, l_1 and l_2 can be calculated from equation (4) if values of L_e have been obtained at a sufficient number of different frequencies to permit elimination of L_M and R_M, both of which are difficult to determine by other means. Equation (4) is likely to give reasonable results for small transformers with a comparatively large leakage inductance, but, for larger transformers, the solution of the equation may be found as a small difference between two large numbers. One method of overcoming this difficulty is to reproduce several points at different frequences on an equivalent inductance-frequency curve by trial and error, using values of L_e calculated from equation (4) with the constants referred to a unity-ratio transformer. This is only likely to be successful if there is an appreciable variation of L_e at lower audio frequencies; it is applicable, however, to single- and three-phase transformers in any connection.

Practical Values

Using this method for a unity-ratio 50 VA transformer, the primary and secondary leakage reactances at 50 c/s were found to be 0·0115 and 0·0110 ohms respectively. For a 500 kVA 12,500/400 V single-phase transformer, the corresponding values were 17·3 and 0·0157 ohms, or 5·6% and 4·9% in terms of the percentage reactance. In both cases, the drop in L_e between 50 c/s and 1,000 c/s was greater than 5%.

It is interesting to note that $l_1/K^2 l_2$ is considerably smaller for the iron-cored transformers than for the air-cored coil (1·05 and 1·10 as compared with 2·23); this is due primarily to the effect of the iron core on the secondary leakage inductance. On the basis of these results it may be argued that the error in assuming that $l_1/K^2 l_2 = 1$ is unlikely to exceed 10%, but there is little evidence to support this argument; the error may be greater in larger transformers. The new method, which ignores frequency effects in copper and iron, is only an approximate one, but it may be useful in cases where other methods of separating the leakage reactances are not applicable.

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Our readers' views . . .

Total Research

ARISING out of "Meteor's" comments in your issue of November 23 on the desirability of adequate research to ascertain fully the users' requirements before new apparatus is manufactured for the home, we would like to emphasise that a golden opportunity for obtaining a widespread consensus of opinion is provided in the new campaign of the Electrical Association for Women. The questionnaire, "Towards Perfection," has been drawn up with the express purpose of enabling users of electrical apparatus to put forward their views on the design and performance of the electrical appliances available today, in order that data and suggestions may be forthcoming to influence the design of the appliances of tomorrow.

Already over 10,000 copies have been circulated all over the country, and the only qualification for expressing a point of view is personal experience of the apparatus under survey.

May we, through your pages, invite all those who come within this category, men or women, to participate in this investigation, the results of which will ultimately benefit both producers and users of domestic electrical equipment.

Caroline Haslett
Director

THE ELECTRICAL ASSOCIATION FOR WOMEN

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Floating Power Plant

THE report in the November 16 issue of the ELECTRICAL TIMES of the use of floating power plant at San Juan and Rio de Janeiro lends point to a recent suggestion of mine that such equipment might be used (but in larger units) on the peak loads when moored at suitable berths in the numerous river estuaries of this island.

The comparative simplicity of this type of plant and the absence of complicated civil engineering works would enable the deficiency of generating capacity to be overtaken more quickly in association with the longer term programme of construction of the more permanent land super-stations.

Peak load plant must of necessity be low in cost, and the advantages in the handling of coal and ash will be obvious.

Recent television broadcasts have shown the S.S. *Aquitania* being broken-up, not to mention the battleship *Warspite*, and one is tempted to ask—Could not the hulls of such ships be gutted out and equipped with suitable quick-starting turbo-alternator plant with a view to overtaking and keeping pace with the ever growing load?

S. H. Hosking
Sub-area Engineer

MIDLANDS ELECTRICITY BOARD, WOLVERHAMPTON.

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T. P. Wilmshurst—An Appreciation

I HAVE noted with great interest in your current issue in "Our Readers' Views" column the remarks of Mr. W. E. Warrilow regarding that great personality who has just passed from us. The expressions so admirably set forth by Mr. Warrilow will be shared by many engineers in the industry who were privileged to enjoy the personal friendship of Mr. Wilmshurst.

My own personal contact, which extended over a period of 30 years, both as an assistant to him and later to take over the duties at Derby, an undertaking which due to his energy and foresight was in the forefront of much that is now standard practice in our industry, enables me to endorse most warmly Mr. Warrilow's comments. Like many other engineers I can say very truly that we were all the better for having known him.

F. Nicholls
Manager

YORKSHIRE ELECTRICITY BOARD, No.4 SUB-AREA, LEEDS.

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Chokeless Fluorescent Lighting

REFERRING to the letter under the name of "Interested," in the November 23 issue of the ELECTRICAL TIMES I can only imagine that your reader is confusing something, which he saw some years ago, with the present developments.

It is a matter of fact, that the overall efficiency of these new chokeless fluorescent lighting circuits is far less than that of fluorescent lighting with the normal auxiliary gear, but is nevertheless approximately double that of tungsten lamps on their own.

E. B. Sawyer
Manager

LIGHTING SERVICE BUREAU

The First Electromagnet

William Sturgeon, its inventor, died 100 years ago

William Sturgeon

NEXT Monday, December 4, marks the centenary of the death of William Sturgeon, contemporary of Faraday, pioneer of the electrical industry, inventor of the electromagnet and founder of the first association of electrical engineers, thus anticipating the Society of Telegraph Engineers, forerunners of the I.E.E., by more than 30 years.

Born in 1787, William Sturgeon was one of those many remarkable men produced during that century. The son of a Lancashire shoemaker, he was apprenticed to that trade, but at the age of twenty-one, after two years as a militiaman, joined the Royal Artillery as a private.

During his army career he spent his leisure hours in the barrackroom studying mathematics, Latin and Greek, modern languages and natural philosophy. He also taught himself lithographic drawing and managed to carry on his original trade while serving in the ranks.

Following his discharge in 1820, on a pension of a shilling a day, he resumed the trade of shoemaker, continuing his scientific pursuits and making several contributions to the *Philosophical Magazine*. In 1824 he was appointed Lecturer in Science at the East India Company's Academy at Addiscombe.

The Magnet

Although, according to Joule, Sturgeon had discovered the soft iron electromagnet in 1823, he did not publish his results until 1825, when he submitted a "complete set of electromagnetic apparatus" to the Royal Society of Arts. The horse-shoe shaped magnet illustrated here consisted of a bent iron rod about a foot long and ½ in. diameter, varnished and coiled with a left-handed helix of 18 turns of stout copper wire whose ends, dipping into the mercury cups shown, made contact with the wires from the battery. This also was Sturgeon's own design, and was considerably lighter than anything previously produced. It consisted of two hollow copper cylinders with a zinc cylinder in between, and had a plate area of some 130 sq in., weighing only 1 lb 5 oz.; the previous smallest battery being Groves gas battery, weighing from 12-13 lb. Nevertheless, the magnet, when excited by this cell, was capable of supporting a 9 lb iron weight. As the inventor claimed:

The original horseshoe electromagnet showing mercury cups for connecting the battery

NOTE—Both illustrations are reproduced from Sir J. A. Fleming's book *Fifty Years of Electricity* (Wireless Press Ltd.).

> *". . . the apparatus which I now submit to the attention and impartial consideration of your valuable Society, acting on the principle of powerful magnetism and feeble galvanism will, I trust, be found more eligible and efficient than any other that has yet been brought before the public . . ."*

At the same time, a straight bar magnet was submitted, with the comment:

> *". . . This arrangement communicates magnetism to hardened steel bars as soon as they are put in and renders soft iron within it magnetic during the time of action; it only differs in being straight, and thereby allows the steel or iron bars to slide in and out . . ."*

The original magnet, in the hands of Dr. Joule, later supported 50 lb, or 114 times its own weight. The Royal Society of Arts awarded him a silver medal and a premium of thirty guineas.

Further Researches

In 1830, Sturgeon published a pamphlet, "Experimental Researches in Electromagnetism, Galvanism, &c." and a year later was working on Arago's "magnetic rotations," and had come to the conclusion that the effects were caused by a disturbance of the electric fluid by magnetic action, when Faraday published his brilliant work on the relation between electricity and magnetism. In 1832 he constructed an electromagnetic rotary engine which was, according to Joule, the first to develop any considerable mechanical force. In 1836, he communicated to the Royal Society a full description of a magneto-electric machine having a longitudinally wound armature and a magneto-electric generator in which an iron core was used for the armature.

In these machines, Sturgeon had eliminated mercury contacts and replaced them by what he called a "unio-directive discharger," the forerunner of the commutator, and he expressed the belief that magneto-electric machines thus equipped would ultimately supersede batteries in the generation of electricity.

For some reason this paper was not published in the Royal Society's *Philosophical Transactions*, and remained unpublished until, in 1850, it was published in Sturgeon's own book, "Scientific Researches." It is interesting to note that his paper specifies the performance of his machines in terms of the quantity of gas liberated by electrolysis of acidulated water over a certain time at a given number of revolutions per minute.

Other work on which Sturgeon was engaged included the solution of certain difficulties in firing of gunpowder by electrical means; the construction of a machine for electric shocks; curing the fracturing of Leyden jars, the unequal heating of the two poles of an arc; non-magnetic alloys of iron; and atmospheric electricity, which involved more than five hundred kite experiments.

In 1838 he was appointed Superintendent of the Royal Victoria Gallery of Popular Science in Manchester, an institution which was, unfortunately, too far ahead of its time and closed, owing to financial difficulties, after only four years. He then had to depend on the profession of an itinerant scientific lecturer—a precarious method of existence. From 1845 he lived in poverty until repeated representations by Dr. Prince Lee, first Bishop of Manchester, and Dr. Binney, president of the Literary and Philosophical Society of Manchester, secured him a Government grant of £200 and an annuity of £50 which, however, he enjoyed for less than two years. He died on Sunday, December 4, 1850, at Prestwich, near Manchester, and is buried in Prestwich Church.

Forerunner of the I.E.E.

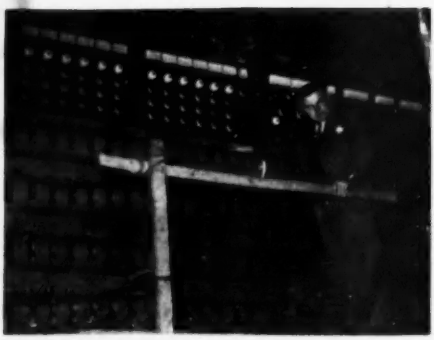
It is not generally realised that Sturgeon founded the first electrical association. The "Electrical Society" held its inaugural meeting on May 16, 1837, with Sturgeon in the chair. With headquarters at 7 Adelaide Street, Strand, its minute book is now one of the treasures of the I.E.E. He also published the first electrical periodical, the *Annals of Electricity*, which ran from 1836, with one interruption, till 1843, when it died for lack of support.

FLUORESCENT STAGE LIGHTING

THE reopening of the Regent Theatre, Kings Cross, as a live theatre will be a noteworthy occasion, since it is claimed to be the first theatre in the world to be equipped with fluorescent stage lighting.

Familiarly known to many Londoners as the "Euston" Music Hall, this theatre has been a cinema since 1927, and is now reverting to live entertainment with a pantomime on Boxing Day. It is being redecorated, re-carpeted and re-seated throughout and equipped with the Atlas fluorescent stage lighting system developed by Thorn Electrical Industries Ltd.

The equipment consists of four-colour fluorescent lighting controlled by a 72-way dimmer board specially designed for both fluorescent and incandescent dimmers, and fitted with 2-way and "off" colour-master switching on the fluorescent section, and individual 2-way and "off" switching on the incandescent section. The fluorescent dimmers are arranged in four rows and the incandescent in three rows, the whole being operated by cross grand master control. The stage is equipped with a float, three battens and a cyclorama batten, and there are ten plugs provided so that the new four-colour fluorescent wing floods or ground rows may be used in conjunction with the incandescent spots which are, of course, an essential part of stage technique.



The control board at the Regent Theatre

The most remarkable feature of this installation is the fact that the total lighting load is only 12·8 kW, which is just a fraction of that which is normally used on a stage of this size. The saving of gelatines is another item which has considerable bearing on the economics of this new form of stage lighting, as by the use of fluorescent lamps of the three primary colours, colour mixing is a simple matter from the switchboard, and some startling colours may be obtained. It is interesting to note that an equivalent incandescent installation of four 27 ft. battens and a float, together with ten 1,000 W floods would consume 37 kW, which is just about three times that of the new system. Added to the above-mentioned equipment there are six F.O.H. 1,000 W spots, and the usual stage, fly and float dips which cater for an incandescent load of 34 kW.

The equipment is being installed by the G.E.T. Installation Co., Ltd., of Croydon.

DESTRUCTIVE HARMONICS

Complicated investigation tracks principal cause of cable breakdowns

CABLE faults should be unusual occurrences, and when their frequency began to rise on the Southern Reg on B R. 33 kV system, a close investigation into the causes was initiated by British Railways and the manufacturers concerned. The interesting story of the combination of unusual circumstances that was discovered was told to the I.E.E. supply section last week, when Messrs. S. B. WARDER, M.I.E.E., M.I.Mech.E. (British Railways), E. FRIEDLANDER, Dr. Ing., M.I.E.E. (G.E.C.), and A. N. ARMAN, Ph.D., M.I.E.E., A.M.I.Mech.E. (Pirelli General Cable Works), read a paper dealing with the work carried out.

The cable concerned is a paper-insulated, oil-impregnated and lead covered type, mainly of 0·1 sq in. cross-section, most of the 416 miles in use being run in either sand-filled surface concrete troughing or in wooden troughing supported on posts. 113 mercury arc rectifier substations are fed by such cable, each consisting of an oil-immersed naturally cooled outdoor transformer and a 2,500 kW, 6-phase 12-anode water-cooled steel tank rectifier.

From 1931 to 1943 there was little cable trouble on the system, but after that year faults occurred more frequently, reaching 14 in the first ten months of 1945. A majority of faults occurred on the yellow phase, and a disproportionate number in tunnels and in cable that was buried.

The faulty cable sections showed that the cable had been well impregnated, and that no excessive drainage had occurred. Waxing seemed extensive, and of a darker colour than usual, and some treeing was found. Small pin holes, often uncarbonised, were usually found in the inner layers of insulation. Cable installed in tunnels showed even more pronounced waxing, and the power factor at working voltage increased with distance from the tunnel mouth.

Cause of Faults

There seemed to be four likely sources of disturbance to account for the faults: (*a*) faulty cable manufacture; (*b*) surges; (*c*) neutral instability; (*d*) harmonics. Possibilities (*a*) and (*c*) were readily disposed of. Closer attention was given to the chance of surges, but it was decided that current chopping, even allowing for voltage doubling due to reflection from open-ended feeders, could not produce a breakdown voltage. Surging rectifiers were even less likely a source of the trouble, since the transformer insulation would be overstressed before the cable papers. Multiple reignition of circuit-breakers dis-connecting an idle cable was also ruled out.

Harmonics remained as the probable cause of trouble, and the possibility of asymmetry (to account for the yellow phase breakdowns) was also to be looked for in detailed investigations. Irregular commutation due to the presence of harmonics, and leading to an amplification of them, was found, and with it some asymmetry in the voltage. As a result of asymmetrical commutation, there was the saturation of the interphase transformers, and all these factors helped to account for the preferential breaking down of the yellow phase, when the asymmetrical iron arrangements of the main transformers and the fact that phase connections were always the same, was taken into account.

Harmonics and Dielectrics

One effect of the presence of harmonics is an increase in the dielectric losses in the cable. For 33 kV cables, however, such losses are only a secondary factor in determining thermal stability. The harmonics in the case under investigation had the further effect of increasing the crest voltage by 20%, causing the cable to operate effectively at 40 kV. This could cause some shortening of life, but other phenomena due to harmonics have a more serious effect.

Some residual voids are inevitable in all solid-type cables, and in the type considered will be stressed at about 123 kV/cm r.m.s. at normal voltage. The larger voids may have a mean breakdown stress of 25 kV/cm, so there will be internal discharges. Investigations not fully reported in the paper have shown that repeated breakdown of voids can occur during intervals of rising voltage, and for a waveform containing harmonics, the number of rising portions, and hence breakdowns, is increased. Indentations near the crest value have the greatest effect, and such indentation was found to be greatest on the yellow phase, the valley formed being 18·5% of the crest height as against 13·5% for red and blue phases.

Voids in the dielectric develop during cable service, and gradually alter their distribution and size due to the heat cycles to which the cable is exposed. Operation under voltage stress only, without heat cycles, tends to give a higher power factor/voltage characteristic than when heat cycles are applied—and the cables in tunnels and buried did not experience heat cycles due to solar radiation.

Conclusions

Summing up, it would appear that breakdown depends on a balance between void formation, and their increase with time and voltage application, and a reduction of the voids by regular heat cycles. If the number of discharges in voids is increased, due to harmonics, and the curing effect of heat cycles is reduced due to the absence of irradiation by the sun, the life of a cable may be shortened very considerably.

Harmonics may be reduced by interconnection, with consequent parallel loads exercising a damping effect. So far this has not been possible to any great extent, but the commissioning of Croydon B power station has provided an opportunity to check this possibility. The use of oil-filled cables, in which voids are less likely to occur, is another recommended precaution.

DISCUSSION

Mr. C. M. Cock (English Electric) said that faults on the system continued to develop at an increasing rate after 1945. He thought, in spite of the paper, that there was no argument against the possibility of faults being due to manufacturing weaknesses in various cable lengths. In any case, reliance should not be placed on the curing effects of heat cycles.

Dr. L. G. Brazier (B.I. Callenders) criticised the authors' statement that heat cycles were beneficial, and said that he did not think that the view put forward in the paper would receive general acceptance amongst cable engineers. He looked for a simpler explanation than was given in the paper. At about the time the cables were made, experience with 66 kV solid type designs showed that manufacturing techniques in the field of impregnation were unsatisfactory.

Dr. S. Whitehead (E.R.A.) said that the E.R.A., which was consulted, were in broad agreement with the explanation offered in the paper, except in regard to the magnitude of the effect of internal discharges and harmonics. He doubted if it would be greater than the effect of the crest voltage increase. He suggested that the concentration of the faults on the yellow phase might be due to some "decrease in the perfection of manufacture." He agreed with the suggestions made for modifying the system design.

Mr. T. R. P. Harrison (W. T. Henley's) thought that the conclusion that the trouble was due to discharging voids was reasonable on the evidence given, but he was not sure if the full story was told. In particular, he asked about the tunnel contour and gradient, and the dielectric thickness. He added that the oil-filled cable was not the only type free from void trouble.

Dr. A. E. W. Austen suggested that the paper contained internal discrepancies, and that in the absence of further evidence the author's case on harmonics was "not proven."

Mr. E. L. Davey (W. T. Glover) spoke of the use of 250 c/s voltages to give accelerated cable testing. He said that harmonic troubles could be avoided by increasing the dielectric thickness with mass impregnated cables, and avoided by the use of pre-impregnated designs. He thought that the increased crest voltage was no reason for breakdown.

Mr. J. H. Mason (E.R.A.) described work carried out by the E.R.A. on discharges in voids in dielectrics, and Mr. Webb (British Railways) reviewed the methods used in obtaining the oscillographic and other field evidence for the investigation. Measurements included the photographing of more than 2,000 oscillograph traces.

Dr. W. G. Thompson (G.E.C.) emphasised that from the economic viewpoint, the results given in the paper had to be considered against a background of rectifier experience, which included very few breakdowns of the type described. Economics also applied to the preventative action; although the use of 12-phase rectifiers would reduce the chance of trouble occurring, this was insufficient ground for abandoning the well tried 6-phase type.

Mr. P. M. Hollingsworth challenged the author's recommendation for the use of oil-filled cable; he thought that they had ignored the improvements that had taken place in solid type cable design. He agreed with the authors' remarks about the beneficial effects of gentle heat cycles.

Mr. C. N. Dawson suggested the introduction of nitrogen at a comparatively low pressure as a means of suppressing ionisation.

Mr. T. E. Calverley (English Electric) thought that in the absence of capacitance there would be very little harmonic content in the supply voltage. In any case, he would have thought that one particular harmonic would have been prominent. He also inquired, with reference to assymmetry, if the yellow phase was joined to the outer-leg windings of the delta-connected transformer.

The authors replied at some length. Dr. Friedlander explained in some detail the discharge mechanism that had been assumed. Dr. Arman said that manufacture in 1931, when the cables were made, certainly left something to be desired, but the important point was that similar cables had given no trouble. The three-phase cables in the tunnel had been cut on site from one factory length, and the dielectric thickness was 0·375 in., with 3·5 mil papers. The tunnel gradient, if there was any departure from the horizontal, was very slight.

Notes on Wiring
by MEGOHM

Lamp Standards

Available lampholders unsuitable for this application

A YOUNG friend of mine, with a flair for woodwork, recently constructed a simple but well proportioned table standard of pleasing design, consisting essentially of a square stem mounted on a square base. Being not unmindful of the dangers that beset the amateur wireman, he asked my advice as to the best method to adopt when completing the electrical part of the fitting; expressing a preference for a push-bar type of holder to control the lamp.

On the face of it, this seems a very simple problem to solve, but the longer one considers the matter, the more complicated it becomes. The first question is how best to change from the $\frac{3}{8}$ in. (in this case) square stem, to the round shape of the holder, without loss to the general neat appearance one hopes to maintain. Consideration of this problem, bearing in mind the stock fitments available, inevitably brings us to the old query whether 'tis better to earth or not to earth. Let us consider the pros and cons.

Lampholders

For most domestic situations I should prefer the all-insulated method, with a holder of the back-plate type, and a suitable "skirt" to enclose the lamp cap. Unfortunately, the only standard holder of this type has a large round backplate, quite unsuitable for our purpose, which leaves us with those having internal or external threads on the nipple of the dome.

Either of these can be used, but are unsatisfactory because they give no adequate anchorage for the flexible lead, and some form of nipple is also required to which they can be screwed.

The alternative, the metal holder, has something to recommend it. It can be had in a variety of finishes, is more robust, need not be fitted with a "skirt" and is slightly smaller in diameter. But we have the same complication that the standard backplate is unsuitable and, what is much more important, a holder of this type must be earthed—unless we can guarantee that it will always be used in an "earth-free" position.

From a casual inspection of the average showroom display of floor and table standards one might imagine that neither aesthetic nor safety considerations have unduly influenced the manufacturers, as a metal holder is usually screwed to some form of brass nipple without any provision for earthing the metal or securing the flexible lead. The latter usually emerges through a bushed or unbushed hole in the side of the base, thus introducing two further points where damage to the insulation may take place.

The nearest relevant standard, B.S. No. 710, entitled "Electric Reading Lamps," admittedly gives general guidance by including a reference to our *multum in parvo* B.S. 816 "Minimum Requirements," and the necessity for earthing facilities where appropriate, but I think something more definite should be included to emphasise these two points.

Some Suggestions

As a solution to the problem I would suggest that what is wanted is a holder, all-insulated or metal, with a deeper base which could be attached firmly to the wooden standard by means of a coarse-threaded bush. The bush should be of the self-tapping variety somewhat similar to a hexagon-headed male bush used for conduit work, but incorporating also some simple form of cord grip. The holder could thus be securely clamped by using an ordinary box spanner.

Most holders have two small depressions which form a register for the porcelain interior, and it would be a comparatively simple matter to make one of these into a sidescrew pinching-terminal to take an earthwire. By suitable design it would then be possible to see if an earthwire were connected by merely removing the lamp, and the size of the body would not be unduly increased, if at all.

Perhaps this suggestion might be considered by those engaged upon the revision of the appropriate B.S. 52, though I appreciate that this must line up generally with the views of our international colleagues.

LORD RUTHERFORD MEMORIAL FUND

EIGHTY years ago, in 1871, was born at Brightwater, near Nelson in New Zealand, Ernest Rutherford, later to become one of the greatest scientists in the fields of physics and electro-magnetism. His arrival in England in 1895 marked the beginning of a career during which the classical theories of the permanence of matter were destroyed and in their place substituted the more modern concepts of the structure of the atom and of radio-activity.

Rutherford's first appointment in this country was as a research student working under Sir J. J. Thompson at the Cavendish Laboratory, Cambridge, a position which he held for three years when, at the early age of 27, he was offered the post of Professor of Physics at Montreal. The work done at Cambridge on the conduction of electricity through gases, and on the ionisation of gas by radiation from uranium salts had led Rutherford and Soddy to derive a theory of "radio-active change." It was only natural, therefore, that further investigation into this topic should have taken place at Montreal.

After nine years in Canada, Rutherford accepted the Langworthy Chair of Physics in the University of Manchester. Here, in collaboration with Geiger, techniques were developed for the detection of individual atomic particles, and these in turn led to the concept of the atom as possessing a minute massive nucleus. Experiments were made to probe the nature of the nucleus by bombarding it with α-rays from radio-active substances, and in the course of this work it was convincingly proved that when nitrogen was bombarded there occurred a rare but definite emission of fast hydrogen nuclei. This was the first occasion upon which controlled transmutation of matter was successfully accomplished.

In 1932 the climax of this work came when Chadwick at the Cavendish Laboratory discovered the neutron and Cockroft and Walton succeeded in disintegrating the lithium atom by artificially accelerated protons. This work owed much to Rutherford's direction and encouragement. Unfortunately, Rutherford did not live to see the great technological strides made in these fields in subsequent years, as he died in 1937.

The Council of the Royal Society has been considering the form a memorial to Rutherford should take, and it has been decided to award Rutherford Scholarships, tenable for three years, to post-graduate students within the British Commonwealth, for research studies, and to hold a Rutherford Memorial Lecture, to be delivered at intervals at selected university centres in the British Commonwealth, at least one in three to be given in New Zealand.

For these purposes a substantial endowment fund will be needed, and contributions should be sent to the Rutherford Memorial Committee, The Royal Society, Burlington House, London, W.1. Forms for Deed of Covenant may be obtained on application to the above address.

Micro-Organisms and Rubber Corrosion

OCCASIONAL failures of non-leaded rubber-insulated cables, buried in the ground, have been found with somewhat abnormal characteristics. A description of these and reasons for their occurrence were given in the September issue of *Electrical Engineering* (the official journal of the America I.E.E.). The failures were characterised by local regions of low insulation resistance. The absorbed water content was no higher than that in adjacent regions and the physical properties appeared the same. By laboratory tests under controlled conditions these failures could be made to occur in a few weeks instead of several years as in natural circumstances, and by a process of elimination it was discovered that the failures were definitely due to soil micro-organisms.

Two distinct modes of attack have been discovered. The simpler one, applicable to natural rubber, is a progressive eating away of the bulk insulation. The second, a more obscure type, creates micropores through the wall, without visible surface erosion. This mode is typical of synthetics in which the base hydrocarbon or polymer does not support microbe growth. Micropores are, however, produced by the microbes living on minute streaks or veins of consumable material scattered in the material.

In order to develop tests which could be applied to fairly high anti-microbe resistant compounds, an ingenious visual method was devised. In this case a sample of the cable material is placed on a thin layer of soil sprinkled over moist sand and left for a week or two. During this time, fungus will develop on the material, and the amount of fungus and its rapidity of formation can give a criterion as to the degree of resistance to corrosion.

The elimination of corrosion by the addition of preventatives is not easy. Many antiseptics are completely unsuitable in conjunction with rubber insulation. Some are effective before the compound is vulcanised, but not after. Others are inactivated by necessary ingredients. Still others leak out and cease to protect the material. On the whole the problem requires a carefully balanced compound to produce insulation with sufficient stability in soil, proper physical characteristics and high electrical quality.

Problems and Practice

IN ENGINEERING

Dangerous Drill

WHILST working at a factory, we received a report that a workman had suffered a severe shock from a portable hand drill.

Two switched sockets had been provided for the workman's use, the sockets being fixed one above the other. He plugged in the drill lead and then an inspection lamp lead. It was when he switched on the two sockets that he received the shock. I should state now that at the time the drill was locked in the "on" position, and it was held in the workman's one hand the whole of the time.

On inspecting the portable drill, we discovered that metal dirt had settled between the bare part of the brush holders and the outer casing of the drill, causing a connection between the two. A break in the earth wire of the lead was also discovered.

The switched socket was then tested and inspected and it was found that the earth connection was loose. The switched socket which was used for the inspection lamp was found to be in perfect order.

When the workman inserted the two plugs and switched them on his body provided a passage to earth between the drill and the inspection lamp switched socket.—*M. R. J. N.*

Straightening an Armature Shaft

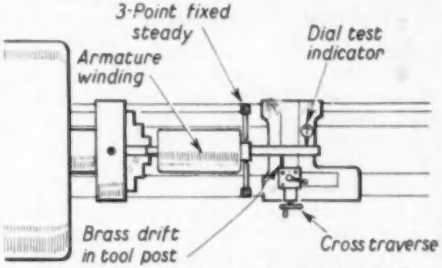
NOT having a press with all the necessary vee blocks, etc. for straightening small shafts, the following method was used to straighten the armature shaft of a 1-h.p. electric motor.

The armature had an extended shaft protruding 6 inches and was bent from the shoulder near the windings which located the ballrace. The diameter of the bent part of the shaft was 0·75 inches.

The armature was held at one end by a 3-jaw chuck in an 8 in. centre lathe, and was located at the other end by a fixed steady, close to the armature winding, as shown in the attached sketch.

By rotating the armature the eccentricity was measured by means of a dial indicator. The reading obtained was 0·045 which represents a bend of 0·0225.

A brass drift was then placed in the toolpost and was pressed against the shaft by the cross traverse of the lathe, the amount of deflection being registered on the dial indicator. It was



Arrangement of lathe for straightening shaft

found that a deflection of 0·08 in. maintained for 5 minutes straightened the shaft by about 0·003 in. after the shaft sprung when the pressure was released.

It was necessary to find by trial and error the best position on the shaft for applying the pressure, after this it was merely a question of time and patience.—*W. F.*

Stentering Machine Stoppage

I RECENTLY called on the manager of a textile-finishing firm, and was quite unexpectedly very warmly welcomed. I hesitated to think that I had acquired an overdose of personal charm overnight, and I was soon given proof that such a miracle was not the cause of my more than cordial reception. It appeared that for two hours immediately prior to my visit a large stentering machine had been stopped, due to some electrical fault which had not been located.

The stentering machine was driven by two commutator motors, controlled by contactor gear. The control circuit consisted of several stop and start push-buttons, inching and other controls which controlled the tension on the cloth, etc. Altogether it seemed that the investigation was bound to be a lengthy one.

Each motor had a thermal trip mounted on the top of the motor frame, this trip opening the control circuit when the temperature of the stator frame became excessive. Very fortunately, perhaps because they were the most readily accessible, I decided to start my search by examining these trips. The first one examined proved to be the cause of all the trouble,

the thermal strip having become detached from its fixing, and leaving the control circuit thus open-circuited at this point. Fitting a temporary copper connection across the terminals resulted in a re-start of the stentering machine, a most audible sigh of relief from the manager, and glances of awe from the waiting operatives! Surely we are entitled to a stroke of good luck now and then !—*A. B.*

Voltage Worries Overcome

BEING in charge of constructional engineering works plant and machinery, I am on various occasions called upon to install cranes and air compressors on sites with supply voltages different from that of our plant. I overcome this by using the primary windings of one or more of our numerous 6-arc, 3-phase welding transformers as a step-up or step-down transformer as required. This enables me to use our standard 400 V, 50 c/s plant anywhere without difficulty. The condensers fitted to the welding transformers are, of course, left connected across the 400 V tapping.—*G. Roughly.*

Contactor Trouble

TROUBLE developed on a group of six 100-amp contactors fed from an arc rectifier controlling six magnetic moulding machines. Each contactor had two separate protected circuits: (*a*) the main d.c. input to the machine; (*b*) the operating coil controlling the movement of the contacts. Circuit (*a*) was protected with 100-amp h.r.c. fuses; circuit (*b*) was protected with 15-amp h.r.c. fuses. The six operating coils were grouped together, through a selector relay which allowed one machine on the main d.c. supply at any one time, to the exclusion of the others.

The relay circuit blew a fuse, but since each machine goes on load for a matter of a few seconds only, and does not follow any given sequence, it was impossible to determine which contactor was causing the trouble. After a brief check over, the fuse was replaced, but it blew again later at irregular intervals. That evening during shut-down the trouble was located.

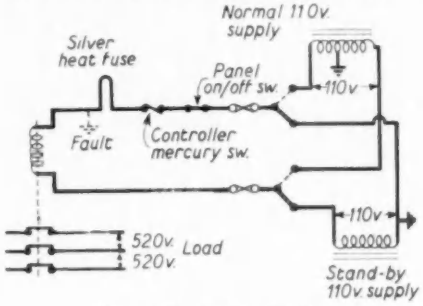
A partial short-circuit, due to damp moulding sand across the *main terminals* of one of the machines, was the seat of the trouble. When the main contacts in the contactor were opening or closing, a "flash-over" to the relay contacts nearby took place, and blew the relay or operating coil circuit fuse.

The fuses protecting the machine and rectifier were of the h.r.c. type, and were able to withstand the momentary surge. The arc shields and blow-out coils were designed to deal successfully with a 100-amp "break," but could not be expected to cope with near short-circuit conditions.

It would have been reasonable to assume that the trouble was located within the relay circuit itself, but in this case the assumption would be incorrect. There has been no further trouble since. If there had been a complete short-circuit the 100-amp fuses protecting the machine would have blown and the trouble would have been obvious from the start.—*T. O'Hanlan.*

Wrong Connection Wrecks Furnace

AN electric furnace with automatic temperature control and a silver safety heat fuse mounted horizontally through the wall was damaged by excessive temperature, such that the heat fuse had obviously been ineffective.



Furnace protective circuit

Investigation found that the control circuit had been temporarily switched to a standby supply of 110 V line to neutral, while the 110 V "centre tapped" supply was being overhauled.

A fault in the temperature controller had allowed the furnace temperature to rise and so melt the heat fuse, which had gone to "earth" when the silver had run between its one-inch insulators and made contact with its sheath. The contactor coil was permanently retained through the heat fuse earth and the fuses remained intact.

On the normal 110 V supply, damage to the furnace would have been prevented by the control fuses blowing and isolating the contactor coil.

Obviously the heat fuse, controller and panel switches had been incorrectly connected to the neutral instead of the line when the standby supply was installed.—*B. J. Sloane.*

Contributions to this page dealing with specific items of interest to electrical engineers and maintenance men are welcome, and, if accepted, will be paid for at our standard rates. Contributions should be written on one side of the paper only and may be accompanied by sketches, which will be re-drawn for publication.

Making Cookers the Modern Way

Elexcel's factory at Liverpool emphasises the elimination of wasted time and labour

THROUGH the courtesy of Elexcel Ltd., we have recently been privileged to inspect what must be one of the most modern and up-to-date factories for the production of cookers and domestic appliances. Their Victor Works at Broad Green, in a "dormitory" area of Liverpool, originally established in 1919, was recently almost doubled in floor space, and the opportunity was taken to reorganise the entire layout of the shops to improve the flow of materials through the factory. Throughout, the emphasis is towards planning for the elimination of wasted time and labour, and on obtaining the best possible quality finish, and no detail which will contribute to either of these ends seems to have been overlooked.

The works is built on rising ground and has been arranged so that production flows downhill, as it were, the receiving end for raw materials being at the "high" end. There is an 11-ft difference in level between the new building and the adjacent older ones; a lift is provided to save the space which would be wasted by a ramp of negotiable gradient.

Materials Flow

Typical of good planning is the unloading bay at the receiving end, which is designed so that lorries are actually unloaded inside the building, being backed into docks excavated so that materials are received at floor level. The doorways to the road are closed with motor-operated shutters, thus enabling a high standard of comfort to be obtained throughout the building, whatever the weather conditions, without the necessity for handling goods through doorways. Steel sheet, which is not at any time an easy material to handle and is a major item of raw material for cooker production, is unloaded in a separate dock actually adjacent to the slitter, guillotines and power press lines, so that it can, if necessary, be transferred directly from the lorry to any machine in one operation of the crane. Guillotining of sheets, except for short runs, has long been superseded by slitting rolls.

As is well known, Xcel cookers make considerable use of pressings, and press work is being extended to cover many components which have previously been carried out by power bending, quite large components such as cooker sides and the main body of the "Calder" fire being produced as straight pressings. This has called for some quite large tools and, in consequence, large presses, the shop containing a 300-ton and two 200-ton units, in addition to a number of smaller machines, totalling some 40 in all, exclusive of fly presses used for smaller operations. In this shop also are housed the other machines, including vertical grinders for iron soles and solid hot plates; and drilling machines for the hotplates and cast iron front frames. Since the policy is towards a self-contained organisation, there are large batteries of automatics and capstans for producing small turned parts. By eliminating outside purchase of components—other than castings and rolled-thread screws—it is felt that delays in production can be kept to a minimum.

This building also houses a well-equipped tool room. Elexcel Ltd. train a number of apprentices as toolmakers and favour a policy of the "fledglings leaving the nest," as it were. On completion of their apprenticeship, they are encouraged to seek employment in other branches of industry for a couple of years or so and broaden their horizon, when they are welcome to return, and it is found that this policy benefits both employer and craftsman. Several of the press tools seen showed a high degree of ingenuity, the oven door handle, once a plastic moulding, is now a very good example of a complicated pressing.

A noteworthy feature of the machine shop is the tidiness overhead. Without exception all machines have self-contained motors and electricity distribution is by means of overhead busbars in steel trunking, with plug boxes.

Welding

The production of sub-assemblies from individual pressings is carried out mostly by means of

Machine shop showing 300- and 200-ton presses

Left : Vitreous enamelling furnaces and chargers

Below : The tool room

spot and projection welding, although arc and acetylene welding have their place. The machines used have air closing with pre-set pressures and automatic timing. One or two pre-war non-automatic machines have been retained for preliminary tacking of components in place prior to more extensive welding. Great stress is laid on the fact that sub-assemblies must fit—not be fitted—and all welding is carried out in jigs.

An interesting feature of production planning is that there is both a pre-welding store and a pre-finishing store. If a certain unit contains both large and small pressings it is unlikely that they will both take exactly the same time to go through the press shop, so that the pre-welding store gives an opportunity for them to be mated-up, and avoids choking up the welding shop with batches of incomplete parts. The pre-finishing store is used in preference to stocking finished parts, which if stored for long periods are apt to be damaged.

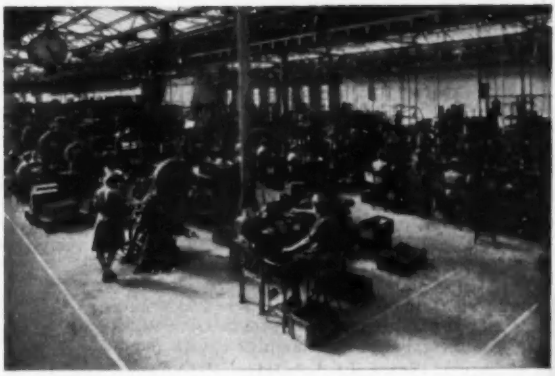
Finishing

Apart from plating, the two main finishes used on all domestic appliances are synthetic enamelling and vitreous enamelling. All parts having a synthetic finish are bonderised first, after which they are degreased in trichlorethylene and sprayed with undercoating, stoved, rubbed down, finish sprayed and again stoved. A number of the older batch type ovens are still retained for stoving, but a considerable amount is carried out by an infra-red conveyor installation which stoves a fire body in approximately four minutes. Gas is used for infra-red heating on account of the increased maximum demand charges which would result in electricity being uneconomic for this process.

Vitreous enamelling is carried out in batch-type furnaces, components being given a preliminary drying time in ovens heated by waste heat from the main furnaces, and these ovens provide another example of careful planning, being fitted with doors both front and back so that they are loaded on one side from the spray booths and unloaded the other side on to the furnace chargers, eliminating much dodging around. Components are run into the furnaces for a few seconds and then removed to be "dusted" with an air spray to remove any loose particles, after which they re-enter the furnace for their normal firing.

Plating of all types is carried out within the organisation, all chromium plating being done over heavy nickel. Extreme care is taken to ensure that all work is under close control, samples of solutions being taken daily from every bath for checking by the laboratory. To ensure the standard of quality of chrome deposits, it is normal for the inspection department to take random samples two or three times a week and subject them to the exacting porosity tests laid down by B.S. 1224. The layout of the adjacent polishing shop has been completely revamped in order to get the best possible light on the job, and there is room to install 70 polishing lathes, although nothing like that number are at present required. Polished parts are an exception to the general rule regarding the stocking of finished items, since the trade in many items is largely seasonal, and to attempt to finish as required would result in a large labour turnover—a state of affairs which the company is determined to prevent.

Batteries of automatics for small turned parts



Machine shop. Small presses, drilling and finishing

Increased costs now make it economical to refinish damaged components which, at one time, would have been scrapped, and a de-enamelling plant is installed for removing vitreous enamel. Since this process is extremely hazardous, involving molten caustic at some 520° C., stringent safety precautions are taken, the complete plant being enclosed in a cubicle with toughened glass windows, and the tank being charged by a hoist remotely operated from outside the housing.

Heating elements are either open spiral or embedded in refractory, and manufacture follows more or less conventional lines, although an interesting item seen was a winding machine developed by the firm themselves which, unlike the more conventional machines, produces an open spiral in a continuous length, using a stationary mandrel only some two or three inches long, round which the wire is wound by a revolving head with internal rollers.

Cooker Assembly

Cookers are assembled on roller tracks (non-motorised), the entire "kit" of parts being placed in double trays at the stores end and gradually proceeding down the line. Points of interest noted were that at several stations, turntable sections were incorporated to facilitate operations, and that the doors were individually fitted, being ground with a portable grinder, and checked with paper strip 0·012 in. thick. Another item worthy of note was the insistence on efficient earthing throughout, all components being bonded together. To ensure good earthing of vitreous enamelled components, thick stainless steel washers are projection-welded on in the sub-assembly stage. These, standing proud of the enamelled surface, can be ground clean during assembly without damaging the enamel, and ensure perfect earthing contact.

After assembly, cookers are flash tested at 1 kV between live parts and earth, after which testing, including individual calibration of the oven thermostat, is carried out. They are then taken to the dispatch department by a motorised conveyor. The maximum output of the four assembly lines is 1,000 cookers a week.

Main electricity supply is by two 750 kVA Ferranti transformers, located outside the Merseyside and North Wales Board's substation, in which, by mutual arrangement, are located the two h.t. breakers. Standby supply is available in the form of a 330 kVA B.T.H. alternator directly coupled to a 400 h.p. Paxman-Ricardo diesel engine. Besides emergency supply, this equipment is in regular use for peak lopping, up to 40% of the factory load being carried during the morning peak. Since parallelling is not permitted by the Board, the factory distribution system is split and the various sections connected by change-over switches. Major load of the factory, and the first to be transferred, is the air compressor installation. There are five compressors, varying from 30-90 h.p., delivering at 80 lb/sq in. Deliveries can be paralleled on to a common air main, if required, with the exception of the supplies to paint sprays which, requiring special precautions regarding freedom from oil and moisture, are always taken from one particular unit.

We are indebted to Mr. J. M. Bussy, works manager of Elexcel Ltd., for the information obtained during our visit.

Above: Reflector fire assembly
On right: Cooker assembly lines

overseas news

Malta's New Station

Reporting to the Legislative Assembly, Malta, earlier this month, Dr. Borg Olivier, Minister for Works and Reconstruction, stated that a new power station, for which funds were being provided by the Economic Co-operation Administration, was an inescapable commitment due to the old age of the existing machinery and the precarious state of the electricity service. Before the last war plans were made by the installation of larger plant and the conversion of the outdated distribution system to the standard 50-cycle, 3-phase operation. The present project follows along those lines, and has already been reported in these columns. The Minister revealed that when an application for assistance was submitted by the Government to the E.C.A. representatives in London, the latter asked for proof that there was no really satisfactory alternative to the U.S.A. as a source of supply of the equipment. Following other investigations, an order for the generating plant was placed with the Westinghouse Electric International Co.—the sets were promised within nine months—but the distribution equipment is to be obtained from Britain. Messrs. Preece, Cardew and Rider have been engaged as consulting engineers for the project. As we have earlier noted, it is proposed to install three 6,000 kW sets, with oil-fired boilers, at a site under Jesuits Hill. It is also planned to supply Gozo from the new station via a submarine cable across the channel separating the two islands.

New Station for S.A.

A new major metropolitan power station will be needed in about eight years, according to the annual report of the Electricity Trust of South Australia, published this month. A possible site suggested is on the east side of the Port River, Adelaide, and a station with an ultimate capacity of 500 MW is being envisaged. The report refers to the careful consideration being given to the major problems involved, including coal supplies, availability of water for condensing purposes and transmission lines. It is also noted that work is to start next year on superimposing a 66 kV system on the existing 33 kV supply in the metropolitan area. The accounts of the undertaking show a surplus of £2,021 out of a total revenue of £3,260,814, but it is estimated that last year's restrictions, due to coal shortages, cost the Trust £200,000 in lost revenue.

Subsidies in Queensland

The latest Australian State to announce special subsidies to foster the electrification of the lesser populated areas is Queensland. Here, the Minister of Mines, Mr. Power, stated recently that special subsidies will be paid to local authorities to establish electricity schemes outside areas supplied by the major electricity undertakings. For townships with 50 to 100 consumers, the subsidy will be 65 per cent. of the capital cost, and for those with 100 to 200 consumers, 60 per cent. The present subsidy of 50 per cent. is to continue where there are more than 200 consumers.

Tasmania's Plans

Plans to speed up the hydro-electric development of Tasmania were referred to by the Premier, Mr. Cosgrove, this month, when speaking during the debate on the Public Works Execution Bill which provides £2,500,000 for the State Hydro-Electric Commission. He said the present capacity of 255,000 h.p. was expected to increase to 290,000 h.p. in 1951 and to 542,000 h.p. with the completion of the Trevallyn and Nive schemes. Additional generating plant at Tarraleah and Butlers Gorge would provide an extra 35,000 h.p., but this was unlikely to be sufficient to meet the extra loading during the winter before the completion of the first stage of the Nive scheme.

Every effort was being made to bring the first Tungatinah power station machine into operation in 1952. It was expected the power station at Butlers Gorge would be ready for use in four months, Mr. Cosgrove said.

Another Ontario Steam Station?

The probability of the establishment of a new steam power station at Hamilton, Ontario, by the Hydro-Electric Power Commission of Ontario, was revealed this month when Mr. R. H. Saunders, chairman, confirmed that the Commission had purchased 48 acres east of the Firestone Tyre and Rubber Co's plant. He said the Commission had considered the advisability of going ahead with the new steam station when decisions were made to add to the generating capacity at Toronto and Windsor.

St. Lawrence Scheme Needed

Continuation of low electric power rates in Ontario is dependent on completion of the St. Lawrence river power development by 1956, Mr. R. H. Saunders, chairman of the Hydro-Electric Power Commission of Ontario, stated a few days ago. The scheme would need at least five years for completion, and it was necessary to begin construction early next year, he urged.

Draft Standard for Insulators

A draft Indian standard specification for porcelain insulators for telegraph and telephone lines has been brought out by the Indian Standards Institution. The present draft, covering pin-type porcelain insulators only, lays down the dimensions, material requirements, and the various acceptance tests necessary.

India's Projects

Opening the 21st annual meeting of the Central Board of Irrigation in New Delhi recently, the Deputy Prime Minister, Sardar Patel observed that altogether 160 multi-purpose schemes were under consideration or investigation in India. These were designed to bring under irrigation 31·2 million acres and to generate eight million kW. He emphasised the importance of scientific planning of crops and industrial enterprises in areas which were to be served by these projects.

A Vast Project

The recommendation that attention be given to the future harnessing of an estimated potential of 1,000,000 continuous horsepower of electrical energy available in the Lake Manapouri area was made to the New Zealand House of Representatives earlier this month by the Industries and Commerce Committee. The Committee has urged that the interested State departments should be asked to report to the Government as soon as possible on how the immense power potential might best be used for the benefit of the Dominion. The area where this reserve of water power is available is unfortunately in the most remote and geographically inhospitable part of New Zealand —the power would be drawn from Lakes Manapouri and Te Anau, in the south-western part of the South Island. Good deep-water anchorage is available, in fiords where power houses would be established, but the area is at present almost uninhabited, and many physical difficulties would confront an enterprise seeking to harness and exploit the power supply. Latest engineering opinion, however, is that the electricity once generated on the south-western seaboard, could without any insurmountable difficulties be transmitted to the cities and towns of Otago and Southland. It has been suggested that a cheap supply of electricity on the seaboard would lend itself to the establishment of an aluminium industry.

A Fuel Problem at Klip

The news that, after 15 years, the "almost unlimited" reserves of coal at the Commission's Klip power station on the Rand are nearly exhausted, must have been a bit of a shock to the Electricity Supply Commission of South Africa, for it was once estimated that the local coalfield would be sufficient for 100 years. The station was constructed about fifteen years ago adjacent to the Springfield Colliery, from whence coal is delivered directly into the overhead storage bunkers of the Klip power station. But other coal deposits at the Grootvlei Colliery, about forty miles away, from which the Commission is already drawing a large proportion of its requirements, are said to be sufficient for 300 years. The only snag is that whereas up to the present coal used at Klip has cost 4s. 7d. a ton, freight charges will add a not inconsiderable amount to future costs.

Report on Lusaka

The report of the Commission of Inquiry into the running of Lusaka's government-owned electricity and water undertaking, published a few days ago, recommends an increase in the staff from the present 19 to a total of 32. According to accounts, the report shows that inefficiency of the undertaking arose from the lack of skilled staff and from improvisation to deal with the rapidly expanding town. Maintenance was patchy, and no attention had been paid to the orderly development of a distribution network because the existing 3·3 kV network was no longer considered economic. Referring to the Easter breakdown, reported in these columns, the Commission feels that there is doubt whether caustic embrittlement was present in the boilers as was suggested. The Commission would have recommended the acquisition of the undertaking by the Lusaka Management Board, but for the fact that a considerable sum would have to be spent on plant, spares and reorganisation. This charge, it is assumed, the Government will meet.

Italy's Power Shortage

In view of the recent statement that power rationing is expected again this winter, at least, in Northern Italy, attention is being focused upon the new generating stations in the area on which work has already begun. Chief of these are situated on the basin of the river Sarca, from which an average annual production of 1,426 million kWh is expected from the plants totalling 583 MW installed capacity. The most important of these stations, that at Santa Massenza, is to have an installed capacity of 388 MVA and, functioning at both seasonal and peak periods, will be the largest Italian generating station.

Vacuum Cleaner Import Duty

Whilst appreciating that the volume of U.K. exports of electric vacuum cleaners to the United States cannot be enormous, it may be of interest to many readers that a Treasury decision in NewYork last week changed the product's tariff classification, and thereby increased the duty assessment on imported vacuum cleaners. The change will mean an increase from a rate of 35% ad valorem to a new compound rate roughly equivalent to 40%, it is stated.

H.E. Scheme for B.W.I.

Proposals for the building of a hydro-electric station at St. Vincent, in the British West Indies were the subject of recent discussions between His Honour W. F. Coutts, the Administrator of St. Vincent and the senior director of Colonial Development Corporation West Indies Ltd., Brig. E. B. Mount. No statement has been issued, but it is understood that the station would be built on the Colonaru River.

PERSONALITIES IN THE INDUSTRY

Chosen as power station superintendent at the new Skelton Grange generating station, Yorkshire Division, B.E.A., is **Mr. H. Bancroft,** A.M.I.E.E., who has been boiler house superintendent at Kirkstall power station, Leeds, since July last year. Educated at Halifax Secondary School and Halifax Technical College, he served in the town's power station from 1931 to 1937, when he became relief engineer-in-charge at the Derby Electricity Works. Two years later he took up the position of combustion engineer to the Kent Electric Power Co., at the Littlebrook power station, where he served as engineer-in-charge from 1944 to 1947. From that time, till going to Kirkstall in 1949, he was at the Halifax generating station, first as assistant power station superintendent, and afterwards as power station superintendent.

As part of its "go-to-the-consumer" drive the South Western Electricity Board has divided its Bristol area into four sections, with a separate commercial manager responsible for each. **Mr. F. G. Lamb** is the commercial manager for Bristol North, with **Mr. A. G. Parsons,** M.I.E.E., covering Bristol Central, **Mr. H. F. Lidster** for Bristol South and **Mr. J. G. Ross** for the East Bristol area.

We are asked to make it clear that **Mr. B. I. Powell,** to whom we referred on November 16, is sales manager to the *Warwick Works, Birmingham,* of William McGeoch and Co., Ltd. His previous activities have been in the contracting and generating side of the industry and with the Electrical Branch of the R.N.; and for some years he was Midland area and branch manager for the Simplex Electric Co., Ltd.

Dorman and Smith Ltd., announce that they have appointed as manager for London and Southern England, **Mr. R. Speirs,** M.I.E.E., M.A.M.I.M.E. He will also represent the interests of their associated companies, D. S. Plugs Ltd., Alorite Ltd., and British Klockner Switchgear Ltd. Mr. Speirs received his early training in the Bradford works of the English Electric Co., Ltd. and until recently was manager of the Plant Division of Crompton Parkinson Ltd., in Manchester and North-West England. **Major Amberton,** for a long time London director, remains on the Board of all the companies of the group.

Mr. R. Speirs

Promoted to manager of the General Electric Co.'s Industrial Heating Department is **Mr. A. L. Dandy,** who, since 1947, has been assistant manager of the Department. He originally joined Salford Electrical Industries Ltd. (a subsidiary of the G.E.C.), in 1919, and subsequently spent five years at the G.E.C. Newcastle branch before transferring to the company's branch at Hull. He became personal assistant to Mr. Settle in the Industrial Heating Department at head office in 1936. Mr. Dandy represents the company on the Executive Committee of the Electric Water Heater Manufacturers' Association, and on the Electrode Steam and Hot Water Boiler Section of B.E.A.M.A., in addition to the Heavy Duty Cooking Apparatus Section of the latter Association.

Mr. A. L. Dandy

Mr. P. J. Ferguson, is relinquishing his position as Scottish branch manager to the British Aluminium Co. Ltd., which he has held since he joined the company in November, 1946, in order to take up a new appointment in the firm's head office in London as export sales manager. He will assume his new responsibility as from January 1. The new Scottish branch manager is **Mr. M. J. J. Richards,** of the company's Midland branch office. He takes over his new duties tomorrow, December 1.

Mr. G. R. Thursfield has intimated to the Board of the Sturtevant Engineering Co. Ltd., that after 52 years' active association with the company, it is his wish to resign as managing director with effect from December 31. Mr. Thursfield will continue as chairman. **Mr. W. E. N. Gwilt,** who has been with the company for over 40 years and a member of the Board for the last nine, has been appointed managing director with effect from January 1, 1951.

At present chief metallurgist of the Park Gate Iron and Steel Co. Ltd., **Dr. H. E. Davies,** F.I.M., Assoc.I.Mech.E., has been appointed metallurgist to the British Electricity Authority at London headquarters. Before joining the Park Gate Co. in 1939 as assistant chief metallurgist, he lectured for a time at the Borough Polytechnic, having previously spent some periods of research at Sheffield University and Oxford University. He takes up his new duties on January 1.

London Transport announces the retirement of **Mr. A. F. Bentall,** A.M.I.Mech.E., technical officer (trams and trolleybuses), after 45 years' service with London Transport and the London County Council Tramways. He joined the L.C.C. Tramways as a mechanical inspector in 1905—two years after the first electrification of L.C.C. horse-tram routes. After war service he became successively rolling stock inspector, technical assistant and senior technical assistant, and was holding the latter position on the formation of the London Passenger Transport Board in 1933. He was appointed Technical Officer (Trams and Trolleybuses) in 1937 and for the past few years has also been in charge of Fulwell trolleybus overhaul works. Arising out of Mr. Bentall's retirement, the responsibility for tram and trolleybus design, development and matters appertaining to rolling stock contracts, as well as inspection, is being transferred to the assistant engineer (development) Buses and Coaches—**Mr. J. W. Wicks,** M.I.Mech.E. —at Chiswick Works, whilst responsibility for Fulwell Works is being transferred to the works engineer (trams and trolleybuses)—**Mr. J. Schofield,** M.C.

Tube Investments Ltd. announce the appointment of **Mr. D. Lacy-Hulbert,** B.Sc., A.R.I.C., M.Inst.F., M.I.Plant.E., as joint managing director (technical) of its subsidiary, Chesterfield Tube Co. Ltd. He was previously director of production of the Steel Tube Division of T.I.

We have news of two new appointments in the general engineering department of the Brush Electrical Engineering Co. at Loughborough. **Mr. R. A. Park,** A.M.I.E.E., M.Inst.F., has been appointed engineer-in-charge of the Power Supply Division, and **Mr. H. Du V. Ashcroft,** B.Sc., A.M.I.E.E., is now engineer-in-charge of the Industrial Division. Mr. Park was previously deputy chief engineer of the Baghdad Light and Power Co. in Iraq, and had earlier served with the Yorkshire Electric Power Co., the North Eastern Electric Supply Co. and the Gosport and Alverstoke Electric Lighting Co. For the past four years Mr. Ashcroft has been senior technical engineering designer with Dorman Long Ltd. Apprenticed with the B.T.H. Co., he served with that concern on d.c. machine design, and later in the service engineers' department.

Mr. R. A. Park

Mr. H. Du V. Ashcroft

Hoover Ltd., have nominated **Mr. P. J. Trotman** as their district manager at Birmingham. He has been with the company since 1946, joining originally as a representative in the Stoke-on-Trent district, and was made district manager at Carlisle in 1947, where he lived until a recent tour abroad. Born at Winchester, he was educated at Aldershot County High School and Farnborough Grammar School. During the war he served in the R.A.F. as a pilot with the Pathfinder force, being awarded the D.F.C. and Bar.

Mr. P. J. Trotman

At the annual general meeting of the Junior Institution of Engineers last Friday, **Mr. P. B. Hebbert,** Assoc.I.Mech.E., was elected chairman with **Mr. N. E. Pillinger** and **Mr. S. R. Broderick,** M.I.C.E., A.M.I.W.E., as vice-chairmen. The members of the council are: Messrs. **A. J. Keeble, A. S. Ladley,** M.Inst.Met., **R. H. S. Rose,** M.I.H.V.E., and **J. R. Edwards** (junr.).

We understand that **Mr. S. V. Williams** has recently joined the boards of Electrix Ltd. and its associate, the Sterling Engineering Co. Ltd. Mr. Williams will be known to many people in the trade; he was general manager of Bendix Home Appliances Ltd.

Mr. S. V. Williams

At present with the Metropolitan - Vickers Electrical Co., **Dr. F. Brailsford,** Ph.D., M.I.E.E., has been appointed to the second Chair of Electrical Engineering tenable at University College, London, from January 1, next.

A prominent figure in the electricity supply industry, **Mr. F. Swarbrick,** A.M.I.E.E., A.M.I.Mech.E. retired this month. He was appointed borough electrical engineer and manager at Hove in 1931, remaining there ever since, and becoming manager of the Hove district at vesting day. Subsequently, the two districts, Brighton and Hove, were amalgamated. Prior to going to Hove, Mr. Swarbrick had been borough electrical engineer and manager at Basingstoke since June 1919, where he was responsible for carrying out considerable extensions both to the diesel generating station and the area of supply. Apprenticed with the Blackpool undertaking, he served with the Leigh Corporation Electricity Department from 1905 to 1911, and in the latter year became electrical engineer and manager to the Galway Electric Co. From 1913 to 1917 he was managing engineer and secretary to the Minehead Electric Supply

Co., Ltd, and then served as chief electrical engineer to the Leek U.D.C. before going to Basingstoke in 1919. At a dinner given in his honour last week, Mr. Swarbrick was presented with an inscribed silver cigarette box by **Mr. E. H. Skinner,** manager of the Brighton and Hove district, South Eastern Electricity Board.

OBITUARY

Sir Frederick Bain, M.C., deputy chairman of Imperial Chemical Industries, and a former president of the F.B.I., died on November 23, aged 61.

The death occurred on November 20 of **Mr. P. H. Neuville,** who had been test superintendent to the Metropolitan Electric Cable and Construction Co., Ltd., since its formation in 1926.

The death has occurred of **Mr. T. Meade,** aged 66, director of Campbell and Isherwood Ltd.

Mrs. Alice F. Adams, chairman of John Bromley and Co. (Wellington), Ltd., the well-known agricultural and electrical engineers of Wellington, Shropshire, died on November 3, aged 83. Her first husband, Mr. John Bromley, founded the business over 60 years ago.

The death occurred on November 25 of **Emeritus Professor J. W. Cobb,** C.B.E., D.SC., formerly Livesey Professor of Coal, Gas and Fuel Industries at Leeds University.

It is with regret that we record the death on Monday last, of **Mr. Frank Forrest,** C.B.E., M.INST.C.E., M.I.MECH.E., M.I.E.E., aged 71, latterly a part-time member of the South Western Electricity Board, but familiarly known in connection with his long association with the Birmingham Corporation Electricity Department. He joined that undertaking in 1906, being appointed to take charge of the substation department, the power station plant and switchgear. Later he became chief assistant engineer of the whole undertaking and succeeded Mr. R. A. Chattock as city electrical engineer and manager in 1930, from which position he retired in 1930. His earlier experience had been gained first with Siemens Bros. and Co., then as chief assistant electrical engineer to Tynemouth Corporation, after which he spent about 4½ years with the Charing Cross and Strand Electricity Co.

We learn of the death, on November 25, of **Mr. John Horne,** M.I.E.E., aged 64, who was London branch manager for Johnson and Phillips, Ltd., until his retirement due to ill health. He joined the company from Westinghouse International, Ltd., 26 years ago as a sales engineer and was made London branch manager in 1945.

The death is reported of **Mr. J. J. Donovan,** last assistant secretary to the Eire Electricity Supply Board.

New Literature

An Introduction to Electronics

by J. Yarwood, M.SC., A. INST.P.

ALTHOUGH even courses in "power" engineering are to an increasing extent including instruction in the principles of electronics, there are many engineers and physicists who pay little close attention to this subject until its increasing application to measurement and control brings them close to it in their work. It is for such men, who require a book of intermediate standard, that the present volume has been written, and by reason of its clear presentation it largely succeeds.

In the early chapters, after a revision of fundamental electric and magnetic theory, the mechanism of electron emission and motion in electrostatic and electromagnetic fields is discussed. Another "revision" chapter, this time on a.c. theory, is followed by chapters on the diode and triode and associated circuits, on valve amplifiers and on valve oscillators. This section ends with a consideration of modulation, detection and heterodyne techniques, and the final part of the book is then devoted to photo-electric tubes, electron optics, the c.r.o., electron microscope, and u.h.f. valves. A helpful feature is the extensive bibliography of books as distinct from papers, for further reading. Published by Chapman and Hall, 329 pages, 8¼ in. by 5¼ in. Price 28s.

Electrical Engineers' Handbook

edited by H. Pender, PH.D., SC.D., *and*

W. A. Del Mar, A.C.G.I.

ONE thousand six hundred and eighty two pages of small type make up this American reference book. So much said, the epithet "comprehensive" may be accepted as justified. Power engineering is the subject covered, the allied complications of communications being dealt with in a companion volume. After mathematics and the appropriate sections of electric and magnetic theory have been dealt with in the early part of the work, various aspects of machine design, operation and application are covered. Each of the nineteen sections into which the book is split has notes on the theory of the plant or method under discussion, a description of contemporary examples, and all relevant tables of constants and properties. Although there is naturally a concentration on American practice, most of the information in this remarkable compilation is of value to the British electrical engineer. Particularly praiseworthy features are the bibliography given at the end of each section and the very full index at the end of the work. Published by Chapman and Hall. 1,682 pages, 8½ in. by 5½ in. Fourth edition, price 68s.

Gas Cushion Cable reinforces London Grid

66 kV Interconnector crosses two rivers in 3½ mile route

MASS-IMPREGNATED gas cushion type cables were selected for a 66 kV feeder reinforcing the B.E.A. London Division primary network by joining existing substations at Wandsworth and Barnes. W. T. Henley's Telegraph Works Co., Ltd. obtained the contract for this project, and the completed interconnection, which was recently energised, has many features of interest to supply engineers.

Two 3-core cables in parallel carry the load over the 3½-mile route. Construction is single lead-sheathed, reinforced, rubber-sheathed and served overall, with 0·4 sq in. conductors for the greater part of the length. Drum lengths were nominally 220 yd, but to facilitate jointing longer lengths were used on some sections, up to a maximum of 262 yd.

An increased conductor cross section of 0·6 sq in. was used where the cable route crosses two main roads. Here, the cables are carried in ducts 15 to 20 ft deep, and the larger size is necessary to maintain the current-carrying capacity. Other obstacles along the route were Bell Lane Creek, near Wandsworth power station, and the River Wandle. The cables are carried across these on galvanised steel cable bridges, respectively 100 ft and 50 ft in span.

Gas Equipment

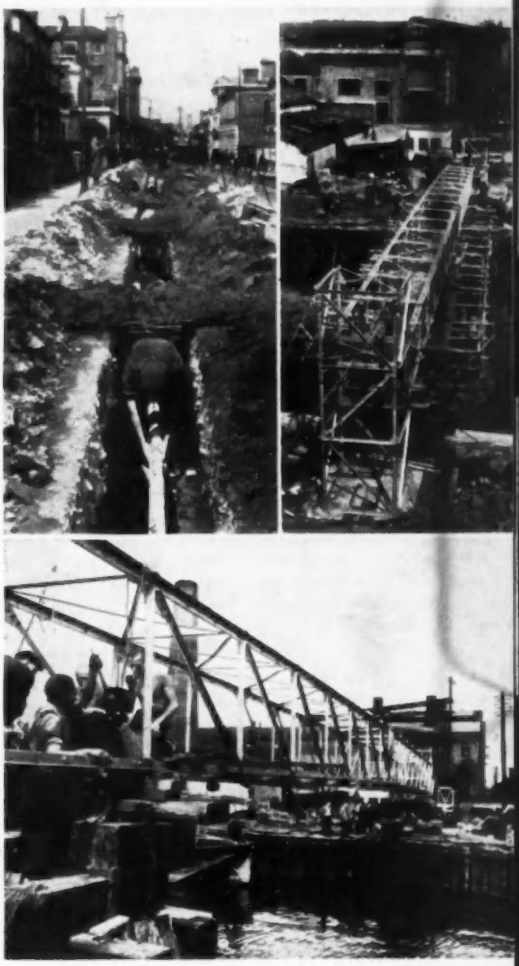
Equipment for feeding and regulating the gas supplies to the feeder is housed in Henley distribution filler shells at both ends of the route. The gas cylinders are connected to the cable by p.v.c.-covered ¼ in. bore solid-drawn copper pipes, and the feeding equipment incorporates alarm relays that give warning in the Barnes power station control should there be any disturbance in gas pressure or flow.

At approximately one mile intervals along the route, gauge connections from adjacent joints are accommodated in pavement and provide means for checking gas pressure during fault tracing.

The 3-core cables terminate in trifurcating joints which lead to single-core gas cushion cables, these in turn finishing in Henley sealing ends mounted on steel structures.

Laid alongside the 66 kV cables are two 5-core p.i.l.c.u.w. cables for split-pilot protection, and a 20-core p.i.l.c.u.w. cable for general control purposes. Six of these 20-cores are used for the gas pressure alarm system described above.

Below left: Pulling in 66 kV cable on the Wandsworth-Barnes route: right: Erection of the cable bridge over Bell Lane Creek, Wandsworth, bottom: Moving the bridge into position



Standard Turbo-Alternators

THE question of standardising large turbo-alternators has been a talking-point in the industry since the introduction of S.R. and O. 2386 of November, 1947 (now cancelled by Statutory Instrument No. 1221 of 1950). A general review of the situation was given last Friday by Mr. I. V. Robinson in a paper, "Standardisation of Steam Turbo-Generating Plant," presented to the Institution of Mechanical Engineers.

He began by analysing existing plant in the country and pointed out that capacities had varied in the United Kingdom by comparatively small amounts for no discernible reason. Units from 10 to 60 megawatts, advancing in steps of 5 megawatts (with the exception of ratings of 35 and 55 MW) had been built. Beyond these there were some units of 75 and 100 or 105 MW.

When considering higher ratings consideration had to be given to transport, as class A roads could only be guaranteed to carry 150 tons including the tare weight of the carrier.

The advantages of standardising operating conditions were obvious and an analysis of units built in 1935 showed a definite trend towards adopting preferred conditions of 400 lb/sq in. at 800° F for 30 MW sets. S.R. and O. 2386 selected 600 lb/sq in. at 850° F for 30 MW and 900 lb/sq in. at 900° F for 60 MW sets.

Although initial temperatures and pressures could be specified, the vacuum available was largely dependent on local conditions, and the author thought that too high a mean temperature was being used for cooling tower stations. He suggested 60°-65° F with a designed vacuum of 28·75 in. instead of 75°-80° F.

On auxiliary plant it was proposed that auxiliary plant should be supplied from either the generator voltage busbars or the output of the step-up transformer when it was solidly connected to the generator. It was also suggested that the exciter should be gear-driven at say 1,000 r.p.m. from the main machine

DISCUSSION

MR. J. W. H. DORE (B.E.A.) deprecated the tendency to regard standardisation as having intrinsic merit. Its objective was to make the generation of electricity more economical and reliable. In his view no case had been made out by the manufacturing side of the industry. As regards cost, the price per set did not vary, however many were ordered at a time, and this would seem to indicate that standardisation would not reduce the cost of production.

The inference that a combination of a unit size of 100 MW with initial steam conditions of 1500 lb/sq in. with 1,500° F was not only economical but sufficiently near to the optimum to obviate the need for variations was not proved.

MR. A. STUBBS said that the case for standardisation must be found in the purpose and objective. The purpose was to increase the amenities available, and this meant more kilowatts.

In post-war conditions, intensive development was required if output was to be increased by standardisation. This must cover boilers, pipes and valves, as well as capacities and operating conditions. The exhaust end of the turbine should be suitable for a standard condition and it was hardly practicable to have two separate exhaust ends for the turbine or to play about with the last row of turbine blades.

MR. R. J. ELDRED (Merz and McLellan) said that while standardisation would benefit both user and manufacturer in some cases, in others the user would be involved in unnecessary expenditure and deprived of possible benefits.

With regard to operating pressures and temperatures, the general limitation lay in the "wetness" of the steam at exhaust.

MR. W. B. SHANNON (B.E.A.) said that on the score of saving coal while at the same time producing more kilowatts standardisation could be justified, particularly if this accelerated the obsolescence of plants of 25 to 30 years old, which were real coal wasters.

MR. G. H. MARTIN (C. A. Parsons and Co., Ltd.) said that standardisation of operating conditions, particularly the pressures of extraction points, would go far towards reducing the time taken to design and produce drawings. S.R. and O. 2386 was a step in the right direction, but it did not go far enough.

There was likely to be a market for tailormade plant for some time to come, particularly for export, and standardisation should therefore apply only to the larger generating plants for home use.

MR. F. L. DONNISON (B.E.A.) said much work still remained to be done before standard vacua could be laid down for river and cooling tower stations. At present there was no indication that a common standard would be justified.

In general, plant users would need to be assured that the advantages offset the limitations inherent in standardisation.

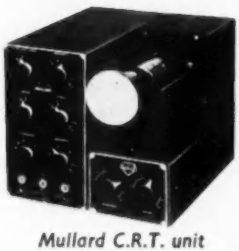
MR. A. W. G. HIRST (Rugby), after dealing with a number of points raised in the paper, said that there was considerable experience in America of advanced conditions, and there were also the pilot plants at Willesden and Brimsdown. As to saving in cost, very few manufacturers had as yet had experience of building standard machines.

MR. P. BETTS (Merz and McLellan) suggested that it would be useful if BEAMA were to publish an authoritative extrapolation for steam tables.

The BUYER'S *Column*

C.R.T. Unit for Colleges

SPECIALLY designed for educational establishments where a moderately priced instrument is needed for demonstrating a.c. theory and the many applications of cathode ray oscillography, the new Mullard B100 unit, with its associated tube-base Amplifier Unit B101, comes at an appropriate time in the post-war programme.



Mullard C.R.T. unit for schools

These two instruments, introduced by the Equipment Division of MULLARD ELECTRONIC PRODUCTS LTD., Century House, Shaftesbury Avenue, London W.C.2, combined electrically, embody most of the features of the normal higher-priced oscillographs.

Among demonstrations which can be made with this unit are those of half and full wave rectification, magnetic hysteresis, harmonics, frequency determination, Lissajou figures, smoothing, and similar phenomena. An additional feature of the instrument is that the amplifier section may be used as a general purpose voltage amplifier without modification.

Kenwood sells direct to Trade

AN important change in sales policy is announced by KENWOOD ELECTRICS LTD., 151 Oxford Street, W.1. It has been felt that the selling of the "Electric Chef" cullinaire with its numerous uses in the kitchen requires closer liaison with the purchaser in order that proper instruction on the use of the equipment can be given. Accordingly, in future the firm will sell directly to the trade and not through wholesalers. A form will be provided for recording the name of the dealer and of the purchaser to facilitate after-sales service.

Visible Image

A WELCOME addition to any bathroom, be the user male or female, is the "Mirrexo" illuminated mirror, manufactured and marketed by C. BRINKMAN AND CO., LTD., Northcourt Works, Chitty Street, London, W.1.

It has a mirror of selected plate glass, bevelled and damp-proof, enclosed in a frame and back of solid white "Perspex." The light from a 15 or 25 watt lamp shines directly through a frosted glass circle in the mirror. The whole unit is neatly and attractively designed and is supplied complete with flexible cable and lamp-holder. Price, inclusive of purchase tax, is £3 15s.

Effortless Control

A HEAVY duty photo-electric control unit is now being marketed by the ELECTRICAL REMOTE CONTROL CO. LTD., 13 and 15 Evanston Avenue, Highams Park, London, E.4, who are specialists in automatic control apparatus.

Prominent characteristic of the T.P.H. is the departure from the use of hard triode, pentode or cold cathode tube and the use in their place of a thyratron for the operation of the output relay. Standard T.P.H. units operate up to four contacts, each capable of switching 15 amps at 230 V a.c., although units with two relays for operating up to eight contacts may be supplied. Normal equipment is for 230 V a.c. 50 c/s supply, although of course other voltages and frequencies can be supplied.

Price Increases

DUE to increases in raw materials and higher labour costs, the HOTPOINT ELECTRICAL APPLIANCE CO., LTD., Crown House, Aldwych, London, W.C.2, announce that as from December 1 the list prices of their complete range of "Torribar" radiant boiling plates will be increased in price by 10%.

The New Bendix Model "D"

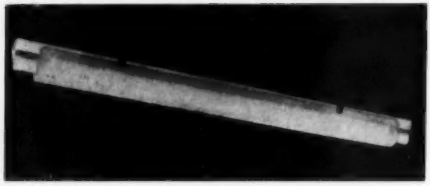
NEW Model "D" automatic washing machine, just introduced by BENDIX HOME APPLIANCES LTD., Albion Works, Kingsbury Road, Birmingham 24, is an improvement on earlier models by reason of the development of the "Dyna Surge" cylinder. This has perforated baffles through which the water is forced into each load of clothes and a new backplate which guides the clothes in an elliptical path ensuring that the load is turned completely each revolution.

It is fitted with temperature controls, a "Water Rationer" to measure water to suit each load and a time-control dial to provide correct timing for soaking and washing. Additional new features are the reversible door which can be hinged either left or right, a point the housewife will appreciate, and the completely flat porcelain top to provide an additional work surface.

The Bendix Model "D"

This new "Bendix," like its predecessors, is entirely automatic, it has in addition a higher extraction speed, giving improved damp drying. Price is £69 10s. plus £17 10s. P.T.

C



Compactness the Keynote

INTRODUCTION is announced by EKCO-ENSIGN ELECTRIC LTD., Southend-on-Sea, Essex, of a compact ceiling fitting batten fitting for use with one 80 W 5 ft lamp, which we have illustrated above. Appearance is neat and unobtrusive. Comprising a backplate, cover and two sleeves and a decorative reeded Perspex diffuser (supplied as an extra), the fitting sells at £5 2s. 6d., or with diffuser at £10 7s. 6d. plus £1 14s. 9d. purchase tax.

Attracting Attention

WE have been able to examine one of the flasher lampholders which are now being marketed by R. E. CHAPLIN & S. A. RICHARDS (C. & R.), 197 Lower Richmond Road, Richmond, Surrey.

These flasher lampholders are of sound construction, the casing is in turned brass with first-quality plastic material used throughout for insulation. The standard model is for 200-250 V for 40 and 60 W lamps and a similar model is available for 100 W lamps.

The holders are simple to install being inserted in any standard b.c. lampholder. Retail price is 7s. 6d.

No Fumes Here

IN many industrial operations, e.g. soldering, welding, chemical operations, etc., the attendant fumes constitute a danger to the health of the operator and consequently reduce working efficiency. Bearing this in mind THE ACRU ELECTRIC TOOL MANUFACTURING CO. LTD., 123 Hyde Road, Ardwick, Manchester 12 have developed the "Pyrobit" fume extractor.

This unit solves the problem in a new way by utilising the heat emission from the lamp which illuminates the bench. It is basically an air duct relying on the elementary principle of convection. The extractor will stand on its own base or may be screwed to the bench or the wall. The height or angle of the funnel can be adjusted to suit any work up to 2 ft high. Length of funnel is 2 ft. and its diameter is 6 inches. Total weight is 11 lb., and the price is £14 (stainless steel funnel) or £9 10s. (aluminium funnel).

This is the "Pyrobit" fume extractor shown in operation.

Electric Proportioning Control

A NEW series of electric proportioning valves and controls of all-British manufacture is announced by the Commercial Division of the BRITISH THERMOSTAT CO. LTD., Sunbury-on-Thames, Middlesex. This series provides fully proportioning control of valves, dampers, motors, etc. in direct relation to changes in temperature, pressure or humidity.

All-electric in operation, the power unit being connected to the controller by one three-core cable only, this system overcomes the limitations of self-contained and pneumatic systems and offers considerable scope for installation and layout.

A full description of the construction and operation of this important addition to the "Teddington" range of automatic controls is available on application to the Commercial Division of the British Thermostat Co. Ltd.

Chrome Finish for Wilkinsons' Tools

WE have been informed that in answer to many requests any of the tools made by WILKINSONS' TOOLS LTD., Kerfoot Street, Warrington, Lancs, may be had in a heavy chromium-plated finish at a small extra cost.

TRADE PUBLICATIONS

STEEL ALKALINE BATTERIES.—Britannia Batteries Ltd., 66 Victoria Street, London S.W.1, have issued a booklet describing "Alklum" batteries in three languages: French, German and Spanish.

INTER-OFFICE TELEPHONES.—The facility of inter-office telephones is now widely appreciated, but in case there are still some firms and organisations which need an introduction to these systems, Reliance Telephone Co. Ltd., 39 Parker Street, W.C.1, have issued an explanatory leaflet.

BLOWERS.—Many are the advantages of the portable electric blower. The "Aerex" blowers by O. N. Beck, 30 West End Lane, London N.W.6, combine these advantages with a high standard of quality. They are described in a leaflet received from the firm.

SPOT WELDING.—Made by Triangle Products Ltd., Hulme, Manchester 15, the Triangle portable tongs spot welder is simple to operate yet has a wide range of uses. A leaflet issued by the company describes it.

Electricity on the South Bank

DETAILS have, this week, been released of the electrical installation in the new L.C.C. Concert Hall which is to be a permanent feature of the Thames South Bank project. The main intake point will be a 1,500 kVA, 11 kV/415 V/240 V substation, from which ten service cables will feed two main switchrooms within the main building.

Vertical distribution is carried out by rising power ducts at each of the four corners of the building. At each floor switchrooms are provided, and cabling from there is taken through a system of low-level ducts and service corridors.

Secondary Wiring

Sub-mains and heavy power circuits use p.i.l.c.s.w.a. cable, while v.r.i. run in screwed conduit is used for most of the sub-circuit wiring. An exception is in the boiler house, and in areas where power of socket outlet wiring has to be installed close to heating pipes, m.i.c.c. cables are being used here.

As lightning conductors, spikes and the copper roof are connected by copper tapes to six electrode pits, each of which has two electrodes driven to about 6 ft below the foundation level of the building. The electrodes are interconnected by a copper tape network which encircles the Hall at foundation level, and this system is used to provide a good earth connection for the h.t. substation and the l.t. switchroom.

Lighting has been kept an integral part of the architecture of the Hall, both as regards stage and general illumination. All the stage and auditorium lights are controllable from a conveniently situated console, the necessary power-operated dimming equipment being accommodated at roof level.

A notable feature of the lighting outside the auditorium is 300 fluorescent-tube illuminated louvred ceiling used for the sunken foyer.

Secondary lighting is fed from a floating battery worked in conjunction with a "Keepalite" mercury arc rectifier.

Extensive sound and telecommunication wiring is provided within the concert hall.

CONTRACTORS

The electrical installation was designed by Mr. Joseph Rawlinson, M.Eng., M.I.Civ.E., M.I.Mech.E., M.I.Mun.E., Chief Engineer of the L.C.C., and the following firms acted as sub-contractors to Holland, Harren and Cubitts:

General electrical installation. . Berkeley Electrical Eng.
Lightning conductors. . . . . W. J. Furse and Co. Ltd.
Electric lifts. . . . . Waygood Otis and Co. Ltd.
Stage lighting and dimming. . . . . Strand Electric.
Sound amplification. . . Standard Telephones and Cables.
Automatic telephones. . . . . Siemens Bros. and Co. Ltd.

Electricity in Aviation

THE position and importance of electricity in modern aviation formed the subject of a paper delivered by Mr. F. E. Bucknell to a joint meeting of the Association of Supervising Electrical Engineers and the Institution of Engineers in Charge, on Tuesday, Nov 21.

It was emphasised that the most important thing in airborne electrical equipment was the reduction in weight; further the electrical loading of such equipment as cookers, water-heaters, lighting and ancillary electrically operated items, had to be kept as low as possible because of the demands of other electrical services on the aircraft.

Two methods were in general use for providing hot meals for passengers in aircraft; (a) by pre-cooking food on the ground and keeping it warm in special electrical containers in the aircraft, and (b) the use of pre-cooked frozen food. The requirements for dealing with these two types of meal were quite different. It was necessary, in the latter case, to provide some quick means of de-frosting the food and making it ready for consumption. To do this G.E.C. had designed an air circulation oven designed to heat up 24 passenger meals in 40 minutes from placing the frozen food in the oven. The loading of this oven was 2,175 watts at 24 V, 2,000 watts being element loading and 175 watts being the fan loading. Aircraft refrigerators and aircraft urns had also been specially designed.

The paper continued by giving details of aircraft lighting equipment and also briefly described the system adopted for airfield main runway, taxiway and general lighting.

Heating oven and refrigerator in aircraft galley (G.E.C.)

THE WEEK

INDUSTRY *in news* COMMERCE

Big Improvement in TV Sales

ACCORDING to the latest R.T.R.A. Index, the numbers of radio and television sets sold during September show a considerable increase over the corresponding month in 1949. An interesting fact recorded in the index is that the number of television sets sold on credit terms has grown considerably. In 1949, 38·42% of total sales were on hire purchase, and this year the total has increased to 47·5%, while sales of radios under the same system remains identical, namely about 37% of total sales.

Average numbers of sets sold per shop during August and September are as follows:

Month	1950	1949
RADIO		
August	10·31	11·71
September	15·05	13·14
TELEVISION		
August	6·77	6·17
September	11·77	8·70

Tungsten or Fluorescent

DEMONSTRATIONS of lighting for shop window display have achieved remarkable success at Northmet sub-area showrooms of the Eastern Electricity Board since their inception about six weeks ago. Dummy windows have been fitted with both tungsten and fluorescent lamps which can be switched on or off from a panel in front of the window. The man responsible is Mr. A. J. Wickens, District Commercial Officer, who invites traders to go and dress the windows and then judge for themselves which is the better for sales.

None has denied that the fluorescent scheme (an example of which is reproduced on page 882) is far more flattering to their goods, but most are amazed to learn that whereas there are nine 100 W tungsten lamps the total wattage in the fluorescent display amounts to only 520 W. This is believed to be the first scheme of its kind run by electricity showrooms. Certainly it might well be adopted by others, as all concerned profit. The shopkeepers benefit by improved lighting, lamp manufacturers by increased trade and the supply industry by the decrease in the use of power, an advantage in these days.

No Unfair Competition

SPEAKING at the annual dinner of the Potteries branch of the Electrical Contractors' Association last week, Mr. H. A. P. Caddell, manager of the N. Staffs sub-area, assured his audience that the Midlands Electricity Board would not compete unfairly with local electrical contractors. He said he did not think the Board's activities would diminish the business of the Association's members, but on the contrary increase it and accelerate its rate.

Closed Shop

AT a meeting last week of the Council of the Engineers' Guild, a resolution was passed concerning the "closed shop" issue. The Guild has sent a copy of the resolution to the Durham County Council, following reports of the latter's decision to dismiss certain employees who were not members of trade unions or professional organisations. The Guild has pointed out that such a policy constitutes an unwarrantable interference with employees' professional and personal freedom, and added that any attempt to impose such a condition of employment on members of the engineering profession would be resisted by the Guild by every possible means. As an Association of Chartered Civil, Mechanical and Electrical Engineers, the Guild is endeavouring to protect the interests of electrical engineers in Durham, should they be affected by the County Council's decision.

Consumers' Association meets M.P.s

SUGGESTED modifications in the present set-up of the electricity supply industry were laid before certain Members of Parliament by the National Municipal Electricity Consumers' Association at a private meeting in the House of Commons last Thursday. The Association comprises local authorities who previously owned a number of electricity supply undertakings, and succeeds the

The First Half-Century

Dear Sir,—Will you draw further attention in your columns to the danger existing in many of our H.T. central and sub stations due to the possibility of accidental contact with live metal work on H.T. switchboards. No more striking proof of this can be given than the recent regrettable fatal accident that has occurred on these boards. The "spit-death" fittings and earth potentials are all brought together in a small chamber behind the main slate or marble base. Will you therefore recommend a remedy? It is to replace all these dangerous boards and remove them. Yours faithfully, Henry W. Clothier.—*(From our issue of 29th November, 1900.)*

Incorporated Municipal Electrical Association, which was formed in 1937 to safeguard the interests of those undertakings and wound up when the industry was nationalised.

The Association criticised the Minister's power to appoint every member of the Area Boards and Consultative Councils, and favours a more democratic method of election of at least 50% of members serving on those bodies. Local authority representatives, who have served on electricity committees for many years prior to nationalisation, would often prove invaluable in the new authorities. Concerning the Consultative Councils the Association stated that they had no powers and were regarded by most people as unimportant. The suggested alternative was the formation of District Committees which would have certain executive powers at present exercised by Area Boards, including the right to spend limited sums of money. It was recommended that there should be a substantial reduction of highly paid staffs at area headquarters, and a redeployment of the large number of electricians now engaged on wiring and canvassing work, who would be better employed in the rearmament programme.

Justification for these reforms was found in the numerous complaints from consumers. Before nationalisation the consumer could personally approach the local undertaking, but since 1948, consumers neither knew how they were supposed to raise their problems nor whom they should see. The Association also stated that the general public could not understand why new electrical appliances were being publicised when existing consumers could not be given the unrestricted supply of electricity to which they were previously accustomed.

Principal object of the proposals, said Mr. A. J. C. De-Renzi, secretary of N.M.E.C.A., was to give consumers a square deal, particularly because of the growing dissatisfaction which had resulted from the loss of contact with elected representatives in the industry. At the conclusion of the meeting, Sir Arnold Gridley, M.P., who has been prominently associated with electricity supply development, said he foresaw the possibility of voicing the suggestions when the annual report of the B.E.A. was debated in the House.

Fuel Efficiency Exhibition

THE Fuel Efficiency Exhibition was opened in the City Hall, Manchester, on Wednesday, Nov. 22, by Viscount Hyndley, G.B.E., chairman of the National Coal Board.

Held under the auspices of the National Smoke Abatement Society, the exhibition featured a wide variety of materials and equipment of interest to domestic and industrial fuel-users. Particular stress was laid on automatic stoking equipment, instrumentation for checking combustion, and the latest advance in the gas turbine, where waste-heat is utilised to produce driving power.

Of general interest was the model section where the use of fuel in various sections of industry was portrayed. Under "Power House Electrical Generation" branch were exhibits of modern boiler-plant by well-known firms such as Babcock and Wilcox, Ltd., John Thompson Water-Tube Boilers, Ltd., while Richardsons Westgarth and Co., Ltd., G.E.C., Ltd. and English Electric, Ltd. were exhibiting generating plant. The exhibition comes to a close on December 2.

No Chandeliers in this Hall

VISITORS to the Newbury Corn Exchange will find a remarkable transformation in the main hall since it was redecorated. The redecoration provided excellent opportunities to install fluorescent lamps which, while giving the maximum amount of light, remained concealed. The main scheme consists of eight framed flush louvres built into a false ceiling, each louvre measuring 5 ft by 2½ ft and hiding three lamp fittings of the stoved enamel reflector type. There are two 5 ft 80-watt lamps in each reflector.

New fluorescent lighting installed in Newbury Corn Exchange

While this gives adequate illumination in the hall, additional decorative effect has been achieved by 40-watt 4 ft fluorescent lamps mounted at sill level in each of 16 deeply-recessed window alcoves. All the above equipment was supplied, through the Southern Electricity Board, by British Thomson-Houston Ltd.

Watch on Henley's

SOME novelty is usually a feature of the annual Henley staff dinner, and this year it took the form of a presentation to Sir Montague Hughman. Ladies representing the various sections of the Henley organisation brought to his table an outsize in watches—and its works, very appropriately, were the Henley Works; framed aerial views of all of them.

Sir Montague Hughman speaking to Henley head office and works' staffs at the company's annual dinner, last week

This year the function was held at the Dorchester Hotel, and some 800 members of all sections of the concern attended. Dr. P. Dunsheath proposed the toast of the Henley companies, suggesting as a major factor in their success the feeling of participation in the business that was evident with both staff and workpeople. A good chain of communications was realised by the directors to be a necessity. Replying to the toast, Sir Montague Hughman reviewed the increasing success of the company in post-war years.

The next speaker was Mr. A. W. C. McArthur, director and works manager, who proposed the toast of the ladies. Miss O. M. Goatham (personnel department, Gravesend) responded, and after this dancing took place to the music of Arthur Salisbury and his dance orchestra.

Wire Production

THE last census of production preliminary report concerns the wire and wire manufacturers' trade. It is shown that the value of the gross output increased from £16,140,000 in 1935 to £24,607,000 in 1937 and £61,844,000 in 1948. In the latter year the 264 establishments employed an average of 33,467 persons —an increase of nearly 50% over the 1935 figure. Insulated electric wire and cables are not included in this report.

Young & Wildsmith Jubilee

ONE of the advantages of a silver jubilee is that although the organisation is old enough to start celebrating its milestones, it is young enough to be rich in memories of the early days. Such was the case with the jubilee which Young & Wildsmith celebrated last week. For the principal toast, there could be no happier choice than Mr. A. B. Wildsmith, director of the Electrical Wholesalers' Federation, who was one of the founders of the company.

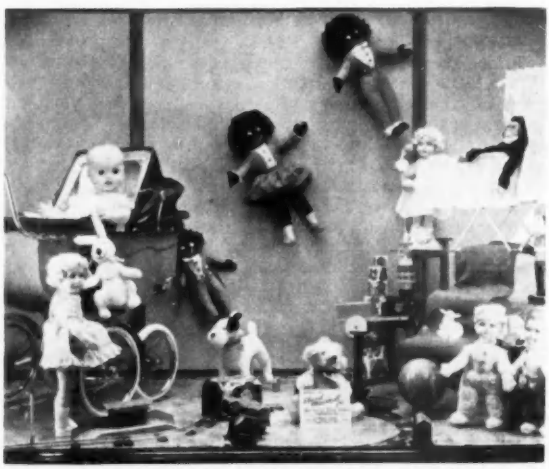
Mr. Wildsmith spoke of the early days of the company which was fortunate in not commencing with too much money. They soon started to develop in the western counties. A branch was opened at Reading followed by one at Ilford, and a third at Luton was opened after he had left the firm. He paid tribute to the chairman, Mr. E. D. Young, and to Miss K. Smith, who had been secretary since the company started.

On behalf of the staff, Miss Smith presented a handbag to Mrs. Young and a salver engraved with signatures of the staff to Mr. Young. In his reply to the toast, Mr. Young spoke of the wartime experiences of the firm, when the staff had been reduced to fourteen and their premises bombed. He then made a presentation to members of the company who had served over 20 years. The toast of "Our Guests" was proposed by Mr. William Crisp, to which Mr. W. Roxburgh replied.

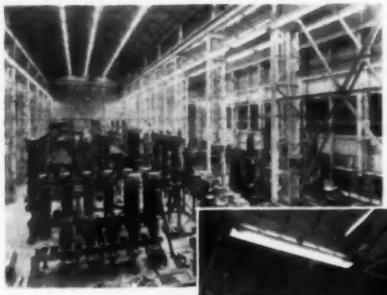
Arts and Crafts

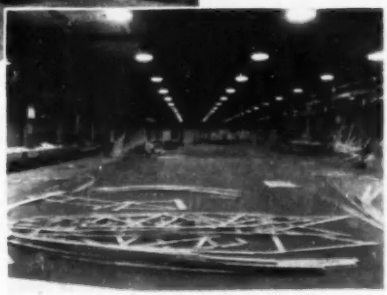
OVER 300 exhibits of a remarkably high standard were on show at the Eastern Electricity Area's Arts and Crafts Exhibition at Wood Green last weekend. The talent of participants must have made the job of judging entries an unenviable task. The judges' difficulties could be recognised in the number of awards given. In most classes—and there were 17 altogether—two or three "highly commended" certificates had to be awarded instead of one as originally intended.

Exhibits ranged from a model village to a simple stuffed doll, and in one section it was noticeable that the quality of furniture shown was better than many pieces seen in the shops today. If this was a preview of the National Arts and Crafts



Display of toys at Northmet sub-area showrooms, showing the effect of the fluorescent lighting scheme





These illustrations show three recent examples of lighting installations in factories. Top left is the new switchgear assembly shop at the Hebburn works of A. Reyrolle & Co. Ltd. where 180 industrial type triple-tube cold cathode units have been installed by the G.E.C. Centre shows fluorescent lamps installed for Sutton Bakeries Ltd., of Coventry, and referred to on this page. Below is the Mould Loft at the Pallion shipyard of Wm. Doxford and Sons Ltd., where the old d.c. system was replaced by 415 V a.c., and all equipment was supplied by Metropolitan-Vickers Co. Ltd.

Exhibition to be held at the Horticultural Hall, S.W.1, on January 11, 12 and 13, visitors will certainly be looking forward to those dates and noting them carefully in their new diaries.

Stourport—A Precaution

THE new 60 MW hydrogen-cooled turbo-alternator recently put into operation at Stourport "B" generating station has been taken out of commission and is likely to be out of action for some little while, according to reports. In a statement issued by the B.E.A., it is explained that there was reason to suspect the end bells of the rotor, and purely as a precautionary measure, the manufacturers decided to change these.

Lighting for Bakeries

MR. PHILIP SUTTON, managing director of Suttons Bakeries Ltd., one of the Allied Bakeries group, fully appreciates the value of good lighting. His company have recently completely modernised their Coventry bakery, installing additional travelling ovens and fully automatic bread-making machinery of the latest design. Even before the additions the bakery was already one of the most up-to-date in the district. The new plant, housed in clean, cool, white-tiled rooms, provides an additional capacity of 2,000 loaves per hour.

The lighting installation, designed by Crompton Parkinson Ltd., and installed by H. P. Mansel Edwards, Electrical Engineer, Coventry, helps to maintain maximum output and adds to the clean and attractive appearance of the entire bakery. Five-foot 80-watt "Daylight" fluorescent tubes in slotted-top Crompton vitreous enamelled reflectors are used to provide 12 foot-candles (lumens per sq. ft) on the working plane in the dough mixing room. The proofing plant and oven room is lit by the same methods to the same values. Similar equipment illuminates the despatch department, to 10-foot candles.

The quality of this installation has been approved by employees and management alike, and Messrs. Suttons are now installing Crompton fluorescent tube lighting in the cake and confectionery departments and in the new office block.

Handy for the Wise Buyer

TUCKED away in the outskirts of London's West End is one of the largest lighting fittings showrooms in the Metropolis.

The works of Frederick Thomas and Co. Ltd., old established lighting fittings firm, is in Everton Buildings, a small turning off Stanhope Street, N.W.1. It is a normal, unpretentious factory yet underneath it houses one of the most spacious yet attractive showrooms that abound in London.

Frederick Thomas and Co. believe that they are here able to show a really representative selection of their well-known "Efteelite" fittings. They believe that no reproduction in print or photograph can do justice to their range of well designed, pleasing fittings better than a personal inspection by the buyer, so they recently fitted out this basement floor.

With the aid of the diagram on the reverse of the company's introduction tickets, prospective buyers should have no difficulty in finding the showroom; certainly if they are wise they can't afford to miss a visit.

I.E.C. 1951 Conference

Although details have not yet been finalised, it is anticipated that next year's conference of the International Electrotechnical Commission will be held at Lisbon, during the first week in July. The Palace Hotel at Estoril has been selected as the probable venue for delegates from some 16 countries who will attend the series of meetings. Details of the papers to be read will be announced later.

Lighting Exhibition at Hull

AN exhibition of fluorescent and tungsten lighting fittings at the premises of T. Beadle and Co. Ltd., of 3/5 Castle Street, Hull, proved a considerable attraction for large numbers of people last week. Arranged in conjunction with the Benjamin Electric Co. Ltd., it drew particular attention to the lasting properties of vitreous enamelling. In addition to the fittings, large photographs of typical installations, and paintings showing the manufacturing processes of vitreous enamelling from early Chinese and Egyptian times down to the present day, were displayed.

A view of the stand of Benjamin lighting equipment at the lighting exhibition at Hull last week

Questions in Parliament

Anglo-Canadian Trade

Introducing a discussion on Anglo-Canadian trade, Mr. Russell dealt mainly with the need to increase our buying of Canadian goods while we were stepping up and broadening our exports to that country. He referred to electrical machinery, particularly dynamos and generators, which the Canadians were anxious to have—especially the heavy types used in connection with hydro-electric power—in greater quantity than they were getting at the moment. Our total exports of generating sets and generators for the first nine months of 1950 amounted to £12,000,000, of which Canada's share was only £467,000, whereas more than £4,000,000 worth went to Russia. He appreciated that the plant sent to Russia might not be suitable for Canada, and not even suitable for this country, but asked if some of the firms could not be persuaded to manufacture a type suitable for Canada? There were, too, many things, notably machinery and domestic electrical appliances, which Canada was importing from the U.S.A. which she would like to come from this country. While aware of the difficulty over the type of appliances made, he thought these could be overcome. Later in the debate, Sir Peter Bennett pointed out that in regard to electrical machinery, it must be remembered that the Americans were there. They owned the capital in many of those organisations, and were insisting upon American machinery and designs being used. We had also lost business because American machines were already there working and they wanted to pair up with them. As regards domestic appliances, they found ours did not suit, and then said we were out of step. That was not so. In many cases we were first in the field and our ideas had been Americanised: then they came back and said "Why are you out of step?"

After other Members had joined in the discussion, the Secretary for Overseas Trade, Mr. Bottomley, answered many of the points raised. Referring to heavy electrical plant, he said that as a result of the efforts of manufacturers, large orders running into several million dollars have been placed in the last few weeks. They included schemes in connection with public utilities such as the Ontario and Quebec hydro-electric authorities as well as others. The importance of our trade relationships with Canada were realised, and there was a genuine desire to see them strengthened.

B.E.A.'s Advertising Policy

When the matter of the general advertising policy of the B.E.A. was raised by Mr. Boyd-Carpenter, the Minister of Fuel and Power explained that he had asked the Authority to inform him on the matter. They had said first that, being aware of the loss and inconvenience caused by the shortage of generating plant, they wished to assure consumers they were bringing new plants into action as soon as they could. Secondly, having accepted responsibility for the widespread advertising which was required to ensure householders, office workers and others only using electricity when they must during the hours of peak demand, the advertising during the winter was concentrated on this problem of peak demand so that the frequency and severity of power cuts might be reduced. Mr. Boyd-Carpenter then asked whether the B.E.A. had informed the Minister of the cost of the present poster campaign. Would he also say whether the portrayal of the erection of large numbers of power stations

was calculated to increase or decrease public demand for electricity? The Minister said, on the second part of the question, he thought it would have neither one effect or the other. With regard to the first part, that was another question. He pointed out that consumers should use more electricity at off-peak hours in order to keep the price down.

Load Shedding

Load shedding during the peak hours this winter had assumed serious proportions, Mr. Isaacs admitted when answering a question by Mr. Osborne. But the staggering of hours of work in industry either on normal working days or by the inclusion of Saturdays would not, in itself, solve the problem. The matter was still under consideration in consultation with the B.E.A. When another member asked if working on Saturday mornings would substantially add to the difficulties of the spread-over, he agreed that it had effects in one direction and different effects in others. But if the B.E.A. considered it would be a useful procedure and recommended it, he was sure industry would adopt it.

Coal for New Stations

Asked if he was satisfied that when the programme for new generating stations was completed sufficient coal would be available for the increased number of stations, Mr. Noel-Baker replied "Yes." As to the extra coal needed, it depended on how quickly the B.E.A. could replace old plant with modern plant, but it was calculated that about 1,500,000 tons more would be needed in each of the next few years.

Farms Electrified, Glos.

A total of 975 farms in Gloucestershire had been given a supply of electricity since the war, said Mr. Tom Williams, replying to a question by Mr. Perkins.

P.T. on Radiators

The abolition or reduction of purchase tax on all electric radiators fitted with approved safety devices was urged by both Mr. Hardy and Mr. L. Lever, and Mr. Gaitskell indicated that he would bear the suggestion in mind.

Science Centre

Some details of the proposal to establish a National Science Centre in London, were given to both Houses of Parliament last week. In the Commons, Mr. Herbert Morrison stated that it has been possible to overcome the remaining obstacles for the adoption of the long-term proposals originated by the Royal Society for a British science centre in London. He pointed out, however, that it will be some years yet before the Minister of Works can build such a centre but that a start will be made as soon as resources can be found, having regard to other urgent claims. Within the science centre new accommodation will be built for the Royal Society and for a number of other leading scientific societies with their important special libraries, most of which are now severely cramped in the rooms provided for them by the Government about a 100 years ago in Burlington House and in other inadequate accommodation. The centre will also include the Patent Office and its library which will be modernised and extended as a first-rate reference library on science and technology. There will also be new offices for the D.S.I.R. and other Government scientific organisations. The centre will be designed to improve facilities and contacts between scientists and the users of science, both nationally and internationally. The Lord President said he hoped to be in a position to announce the selection of a site as early as possible in the New Year. Much detailed planning remains to be done, and it will be some time yet before the final scheme can be developed. The President of the Royal Society, Sir Robert Robinson, O.M., is expected to make a fuller statement about the proposals in his Presidential Address today, November 30.

Copper Wire

The Minister of Supply was asked if he would make available to British industry during the present shortage the large tonnages of copper wire ordered by China, and now going into storage in this country and the export of which he had forbidden? Mr. Strauss replied that he understood that no copper wire had yet been stored to the order of Chinese purchasers, and therefore the question of diverting it to home uses had not arisen.

Telephone Service

Raising the question of the telephone service, Mr. Bell said that the average wait of a non-priority applicant for a telephone was about three years. He knew of people who had been waiting six years. Applicants enjoying the highest priority were having to wait two months, whereas before the war they waited only a fortnight. About 500,000 people were on the waiting list.

After other members had spoken on the subject, Mr. Hobson, Assistant Postmaster-General, said that the shortage of telephones was caused by a lack of cables, exchange equipment, and buildings. The demand for telephones was half as large again as it was before the war. Applicants waiting for telephones numbered about 530,000, and approximately £300 million would be needed to wipe out the waiting list and pay for the development work.

In June, 1945, the number of telephones in Great Britain and Northern Ireland was 3,903,000; at the end of September, 1950, there were 5,294,000. One in four of the telephones in this country had been installed since the war. There had been an increase of 78,000 residential subscribers in the last few years, and the department was doing all it could to meet the need, within the capital expenditure limits.

Woolwich Power Station

The London Transport power station in Old Woolwich Road is now being supplied with better quality coal and this, together with alterations soon to be made to the boilers, should reduce any nuisance caused by the emission, stated Mr. Bevan in answer to a query about local air pollution.

Electric Supply News

Battersea

Work started this week on the final stage of the civil construction of Battersea power station. The civil engineering contract, being undertaken by Taylor Woodrow Construction Ltd., includes extensions to the switch house, boiler house and turbine house; a new office block and a fourth chimney 350 ft high. The work is to be completed in eighteen months.

Derbyshire

The coming of electricity to the village of Edale was celebrated in the local hall recently. The guest of honour, Mr. H. Haddock, manager of Sheffield No. 3 Sub-Area, Yorkshire Electricity Board, said it cost £8,000 to bring power to the Edale Valley's 80 consumers.

Extension of the power cables to Edale completes the Hope Valley electrification scheme started more than 20 years ago. When the celebrations ended the villagers made their way home by torchlight—street lighting has yet to come.

Edinburgh

A power failure in the city on Wednesday of last week was caused by a breakdown at Portobello power station, according to reports. An unusual combination of weather conditions was blamed for the occurrence—flooding, the incidence of the tides, and a strong wind. Apparently the swollen and flooded Figgate Burn which flows near the Portobello station, carried in its stream an immense amount of dead leaves and rubbish which became deposited on the shore of the Firth of Forth. The incoming tide later forced the debris into underwater tunnels supplying cooling water to the station, thereby causing the generating plant to be shut down.

Malvern

Referring to opposition to the proposal to run power supply lines across the Malvern Hills, Ald. W. Lewis, chairman of the Midlands Electricity Board, told the Area Electricity Consultative Council last week that there was a mind at Malvern that would oppose the scheme at any cost. Using underground cables would cost £20,000, and with an expenditure of £170,000 needed on strengthening the network in Malvern, it was necessary to save all they could in that district, he pointed out. The Board had reverted to its original suggestion of using wooden poles, and in his view the scheme was beautifully sited and would in no way affect the amenities of the Malvern Hills. He was prepared to meet, on behalf of the Board, any responsible body of representatives from any part of the area. It was essential that the scheme should go forward as soon as possible, he urged. A further proposal is reported—that of placing the line through the disused Malvern Wells-Colwall railway tunnel.

Marchwood

Hampshire C.C. Planning Committee has approved in principle the proposal of the B.E.A. to erect a new generating station at Marchwood, but has asked for further details of the Authority's plans for dealing with ash, and has suggested that the station be oil-fired instead of coal. The New Forest R.D.C. and the Southampton T.C. have already decided not to raise any objection to the scheme. At the latter's recent meeting, it was reported that the B.E.A. had stated that although the plans for the main transmission lines from the station had not yet been finalised, they did not involve routes through the New Forest.

North of Scotland

The latest constructional scheme (No. 26) of the North of Scotland Hydro-Electric Board concerns the Mucomir project, details of which have now been issued. It is proposed to utilise water from Loch Lochy in Inverness-shire for the annual production of 9,000,000 units to augment supplies in Fort William and the surrounding district. Under the scheme, use would be made of the flow of water through the Mucomir Cut, an artificial channel that is part of the Caledonian Canal works, after the needs of the canal have been met. Water would be supplied to a power station housing one 1,500 kW turbo-alternator, by a short tunnel from the Mucomir Cut and discharged into the River Speam.

Oxfordshire

At the recent meeting of the C.C., the County Planning Committee reported that they had told the B.E.A. they were not satisfied with the need for a generating station at Littlemore, and that they were alarmed at a proposal which would seriously affect the amenities of the city.

Yorkshire

Following objection by the Ilkley U.D.C. to the erection of o.h. cables from the town to the summit of the Moor, an alternative proposal for running the line from the Keighley side is under consideration.

LIGHTING SCHEMES

Carnoustie (Angus).—The T.C. is applying for sanction to borrow £3,800 for electric street lighting in several roads.

Hoole (Ches.).—The U.D.C. is applying for sanction to borrow £3,852 for a proposed lighting conversion scheme in Hoole Road.

Montrose.—The burgh surveyor is to prepare a report on the installation of improved lighting on the trunk road.

Plymouth.—A sub-committee has drawn up a scheme of illuminations for 1951, estimated to cost £9,500.

Southport.—The Lighting Committee is to apply for loan sanction for a new lighting scheme which will operate in different parts of the town, at a cost of about £7,000.

Company Activities

British Electric Transformer Co.

Profit on trading for the year ended June 30 last, after charging administrative expenses, is £192,839, as against £111,569 for the previous nine months. To depreciation of fixed assets £5,710 (*£4,495*), contribution to land and buildings obsolescence reserve fund £9,108 (*£5,594*), directors' remuneration for management £1,750 (*£2,074*), while £12,556 (*£6,189*) is added to specific reserves. After adding £4,110 income from investments, and deducting £98,964 (*£66,718*) for taxation, less adjustments relating to previous years, the net profit amounts to £68,861, as compared with £44,012, to which is added £1,040 (*£961*) brought in. After allowing £5,240 for Cumulative Preference dividends, and £42,167 (*£28,416*) for the dividend of three tenths of a penny per share on the 5s. Ordinary shares, there is a balance of £22,492 carried forward.

Bullers Ltd.

Trading profit, etc., of this old-established firm making o.h. line equipment, etc., amounted to £368,887 for the year to July 31, as against £306,430 for the previous twelve months. To emoluments £29,689 (*£29,581*), depreciation £18,662 (*£16,890*), and taxation £158,932 (*£133,000*), leaving a net profit of £156,726 (*£120,462*). The deductions include £30,000 (*£25,000*) to pensions, £25,000 (*same*) to plant replacement reserve, and £25,000 (*same*) to dividend equalisation reserve. After payment of the interim 5% Ordinary dividend and final 10% (*both same*), there is £155,490 (*£101,373*) carried forward.

Crompton Parkinson Ltd.

Consolidated profit from trading, for the year to June 30 last, after charging depreciation, directors' emoluments and interest on fixed loan, is £1,444,105, compared with £1,390,319 for the previous period which covered nine months for the parent company and two subsidiaries, 12 months for four subsidiaries, 14 months for four others and 15 months for four more. After charging £291,289 (*£195,664*) to depreciation of fixed assets, plus directors' emoluments, interest on fixed loan, expenses in connection with increase of capital, and charging £666,183 (*£708,078*) to taxation, and £231,654 (*£182,890*) to specific reserves, the net profit is £560,710 as against £514,526 for the previous year. Of this sum, £491,335 (*£499,799*) relates to Crompton Parkinson. Dividends paid absorb £115,418 (*same*), and there is recommended a final 3½% plus 3¼% cash bonus on the Ordinary and "A" Ordinary stock, leaving £1,866,563 (*£1,877,459*) carried forward.

Drake and Gorham Ltd.

With a consolidated income of £33,230 (*£52,994*), the net profit, after allowing for taxation, depreciation, etc., amounted to £14,158 (*£21,836*). Dividends, including 5% on Ordinary, takes £6,187, leaving £41,413 carried forward.

Electric and Musical Industries

The consolidated trading profit of the company and its subsidiaries in England and British overseas territories for the year to June 30 was £756,238 (*£890,418*), plus non-recurring items and items relating to previous periods £160,000 (*£150,000*), tax provisions not required £74,007 (*£28,223*), and investment income £86, making a total of £990,331 (*£1,078,006*). The sum of £112,317 (*£91,628*) is allocated to pensions, £80,000 (*£71,304*) to note interest, £232,706 (*£196,949*) to depreciation, and £201,499 (*£351,905*) to taxation, the net profit being £342,809 (*£346,720*), of which £145,750 (*£206,250*) relates to the parent company. After payment of dividends, including ordinary 6% and bonus 2% (*both same*), there is £491,893 (*£463,241*) carried forward.

Plessey Co.

Trading profit to June 30, before depreciation, was £254,209 (*£261,965*). The final ordinary dividend is again 10% (making 20%, *same*). There is £100,000 (*same*) transferred to reserve for enhanced cost of replacement of fixed assets and £6,605 to depreciation. To taxation £86,917, equalisation reserve £20,000 (*nil*), subsidiaries, special adjustment £10,869 (*nil*), leaving net profit £58,014 (*£84,194*). The group carry forward is £120,804.

Radiovisor Parent Ltd.

For the year to March 31 last, the trading balance amounted to £5,032, an increase of £488 over the previous year's figure. The profit is £4,170 (*£4,039*).

Sun Electrical Co.

Trading profit, etc. for the year ended April 30 last, amounted to £89,673, an increase of £8,100 on the total for the previous year. To taxation £37,614 (*£33,572*), and other deductions absorb £16,284 (*£15,444*), leaving a net profit of £27,184 (*£23,557*). To Preference dividend (net) £5,156 (*same*), Ordinary 10% (net) £5,132 (*£3,849*), and to general reserve £10,000 (*same*), leaving £34,050 (*£21,154*) carried forward.

Dividends Declared

Aerialite. Final dividend of 50% (87½%) on larger capital, making 112½% (150%) for the year.

T. Clarke and Co. Interim of 9% (actual).

Dewhurst and Partner. Final ordinary dividend 25%, making 35%. Profit, before charging taxation, is £76,738 (*£67,125*).

Marco Refrigerators. Final dividend 10% (17½%), making 17½% (30%). Net profit, before tax, is £31,665 (*£66,711*).

Morphy-Richards Ltd. Final dividend 25%, making 40%, on capital increased by a 300% share bonus. (Dividend last year, on old capital, was 160%).

Vactric Ltd. The directors announce that the dividend on the 6% cumulative preference, due on December 1, will not be paid.

Commercial Information

CONTRACTS OPEN

HOME

Dec. 4.—Colwyn Bay. Supply and erection of two electric centrifugal water pumps. Borough Engineer, Town Hall.

Dec. 4.—Fort William. Electrical installation at Belford Hospital, Fort William, for Northern Regional Hospital Board (Scotland). Board's Architect, c/o Raigmore Hospital, Inverness.

Dec. 4.—West Bridgford U.D.C. Supply and erection of 61 concrete columns with 140 W sodium enclosed lanterns and ancillary equipment over 1½ miles on Loughborough Rd. Engineer and Surveyor to the Council, R. C. Dewsberry, The Hall, West Bridgford, Notts. Deposit £2 2s.

Dec. 6.—Peterborough. Renewing portions of electrical installation at St. John's Hospital, Thorpe Rd., for C.C. County Surveyor, County Offices, Bridge St. Deposit £2 2s.

Dec. 8.—Lancashire. Electrical installation at proposed school clinic and child welfare centre at Droylesden. Applications by above date to County Architect, County Offices, Preston. Deposit £2.

Dec. 8.—Manchester. Supply of street lighting lanterns, auxiliary equipment, time switches and steel standards and poles for period up to Dec. 31, 1951. City Surveyor, Town Hall, Manchester 2. (See Nov. 23 issue.)

Dec. 9.—Warrington. Supply and erection of three d.w.f. pumps each of 600 g.p.m. and two storm water pumps each of 2,000 g.p.m. with electric motors and switchgear. Borough Surveyor, Town Hall. Deposit £2 2s.

Dec. 11.—West Riding. Electrical installation of drive lighting and main supply at Bretton-Hall Tech. College. County Architect, "Bishopgarth," Westfield Rd., Wakefield. Deposit £1 1s.

Dec. 11.—Dewsbury T.C. Lighting installation and structural alterations, building of external lift well for installation of passenger lift in Victoria Hall. Separate contracts. Borough Architect and Buildings Surveyor, Town Hall.

Dec. 11.—Dublin. A.C. motor-d.c. generator set direct coupled on combination bed plate. D.C. generator, compound wound, continuously rated 5 kW, 110V. Technical Schools, Bolton St., Dublin.

Dec. 11.—Hemel Hempstead. Electric wiring to 18 existing houses at Leverstock Green. A. H. Turner, Borough Engineer, Market Sq., Hemel Hempstead.

Dec. 11.—Sowerby Bridge U.D.C. Electrical installations in 75 houses on four estates and under separate contracts of 35, 18, 12 and 10 houses. J. Normanton, Architect, Council Offices. Deposit £1 for each contract.

Dec. 11.—York. Electric lighting, heating, cabling installations, etc., in reconstruction of Fulford pumping station. Chas. J. Minter, City Engineer and Architect, Guildhall. Deposit £2.

Dec. 12.—Gillingham T.C. Electrical installation in shops, maisonettes and flats in Twydale neighbourhood. Borough Engineer and Surveyor, Municipal Buildings.

Dec. 13.—Grimsby T.C. Electrical installation in erection of Highfield secondary grammar school and Chelmsford Ave., modern school. Names to be submitted by above date to J. V. Oldfield, Borough Engineer and Surveyor, Municipal Offices, Town Hall, Sq. Deposit £5.

Dec. 13.—Aireborough U.D.C. Reinforced columns and brackets, also supply of lanterns and auxiliary gear for installation of fluorescent street lighting along 2½ miles of Leeds Rd. Engineer and Surveyor to Council, Council Offices, Rawdon, nr. Leeds. Deposit £2 2s. (See Oct. 12 issue.)

Dec. 13.—Bournemouth T.C. Supply and erection of a neon sign installation at the Pavilion, Westover Rd. Borough Architect, Town Hall. Deposit £1 1s.

Dec. 15.—Manchester. Electrical installation in 38 shops, maisonettes and garages. City Architect, Town Hall. Deposit £1 1s.

Dec. 16.—Swinton and Pendlebury. Supply and erection of concrete columns, bracket arms and wiring, and supply of lanterns, lamps and auxiliary gear for Manchester-Bolton (A.666) Rd. Borough Engineer and Surveyor, Town Hall, Swinton, Lancs. Deposit £2 2s. (See Nov. 16 issue.)

Dec. 18.—Lees U.D.C. Supply and erection of 18 reinforced concrete columns and lanterns with 140 W sodium discharge lamps for section of High Street; also for 21 columns, lanterns, and lamps for part of Huddersfield Rd. Council Offices, Cross St., Lees. Deposit £2 2s.

Dec. 18.—Pudsey T.C. Electrical work in erection of 42 houses on Southroyd Park site. Borough Surveyor, Town Hall, Deposit £2 2s.

Dec. 28.—Winchester. Supply and erection of two diesel engines (each 100 h.p.) and a variable speed electric motor (100 h.p.) for driving 3 existing pump sets. City Engineer, Guildhall. (Advertised in this issue.)

Dec. 30.—Haslemere U.D.C. Supply and erection of electric motor of approximately 60 b.h.p. to drive multi-stage centrifugal pump, with starting and automatic gear. Engineer and Surveyor to the Council, Council Offices, Museum Hill. (Advertised in this issue.)

Jan. 12.—Kidderminster. Installation of new radio equipment for (approx.) 90 beds at Kidderminster General Hospital. Hospital Administrative Officer, Mill St., Kidderminster. (See Nov. 23 issue.)

No date stated.—Shrewsbury T.C. Electrical rewiring of whole of Music Hall building. Apply to F. R. Dinnis, Borough Surveyor, Guildhall. Deposit £2.

OVERSEAS

*Details of items marked * may be obtained on application to Room 1076, Board of Trade, Thames House, North Millbank, S.W.1, quoting reference.*

Dec. 14.—Norway. Oslo Lysverker require meters clock-switches and current transformers, working voltage 230 V. B.o.T. (Ref. CRE (IB) 71105/50).*

Dec. 14.—Wellington (N.Z.). G.P.O. (Stores Division) invite tenders for supply of 41,000 switchboard lamps. 5,000 required within two months of

receipt of order. Quotations to Director-General, G.P.O., Wellington C.1.

Dec. 26.—New York. United Nations are calling for 1,300 single-switch multi-lingual units and 800-double switch multi-lingual units. Delivery required by Mar. 1. B.o.T. (Ref. CRE (IB) 70986/50.)*

Dec. 27.—New York. United Nations invite tenders for 10 horn-type loudspeakers, 1,500 table and chair loudspeakers, 30 cone-type loudspeakers and 95 transformers. B.o.T. (Ref. CRE (IB) 70985/50).*

Dec. 31.—Jerusalem. Postmaster General invites tenders for telephone line equipment, private branch exchanges and telephone instruments. B.o.T. (Ref. CRE (IB) 70555/50.)*

Jan. 12.—Brisbane. Supply of porcelain insulators and hardware for City Council. Specifications from Dept. of Electricity, Kelvin Hse., Adelaide St., at cost of 10s. 6d.

Jan. 15.—Pakistan. Supply of power transformers and switchgear for hydro-electric project. Documents obtainable from Supply and Stores Dept., 39-40 Lowndes Sq., S.W.1. Deposit £2 15s. Ref. SS 3561/GS should be quoted.

Jan. 23.—Wellington (N.Z.). Supply of 650 V a.c. switchboards incorporating pillar-type feeder units. Documents available from Electricity House, Cuba St.

Jan. 24.—Queensland. Supply and erection of evaporator to supply boiler feed make-up for Hume St. power station of Mackay City Council. Specifications from State Electricity commission, Scottish Union Hse., Eagle St. Deposit £2 2s. B.o.T. (Ref. CRE (IB) 70848/50).*

Feb. 28.—Syria. Tenders invited for the sound insulating, acoustic treating, lighting of five studios and control rooms for General Director, Posts, Telegraphs and Telephone Dept., Ministry of Communications, Damascus. B.o.T. (Ref. CRE (IB) 70338/50).*

March 20.—Wellington (N.Z.). 100 MVA, 11,000 V switchgear of single busbar indoor metal clad drawout type with accessories, comprising a 6-panel switchboard (1 incoming panel and 5 feeder panels), bus oil immersed isolator switch, bus potential transformer, outdoor current transformer. State Hydro-Electric Dept.

April 10.—Wellington (N.Z.). Supply of (a) 1,000 50 kV pin-type insulators; (b) 6,000 pillar insulators, 13,000 strain insulators and 1,500 insulator hooks and eyes and strain clamps; (c) 1,800 suspension strings of extra h.t. insulators, 180 strain insulator assemblies and 90 jumper insulator assemblies; (d) 376 suspension strings, 156 strain insulator strings. State Hydro-Electric Dept.

April 17.—Wellington (N.Z.). State Hydro-Electric Dept. want a 5,000 kVA 11/10/6·6 kV transformer bank and spare unit for Dobson substation. Documents available at N.Z. Govt. Offices, John Adam St., W.C.2.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller

Fisher-Washette (with design). 690,329. Class 7. Washing machines. H. Fisher (Oldham), Ltd., Glodwick Rd., Oldham, Lancs.

Hick Hargreaves. 691,067. Class 7. Condensing installations, steam jet air ejectors, feed water heaters, etc. Hick Hargreaves and Co., Ltd., Soho Ironworks, Crook St., Bolton, Lancs.

Techniquip. 688,501. Class 9. Electrical apparatus and instruments. Mc. and B. Heat Control, Ltd., Raydown Ironworks, 89, High St. Epping, Essex.

CONTRACTS PLACED

Bexley T.C. Installation of sodium lighting in a number of streets. Revo Electric Co. Ltd., £5,139.

Doncaster. Repair and overhaul of lift at Royal Infirmary for Sheffield Regional Hospital Board, Waygood-Otis Ltd., £1,272.

Glasgow. One 30,000 kW turbo-alternator set costing £287,033 (condensing plant valued at £63,400 to be manufactured for Metro-Vick by G. and J. Weir Ltd.) for Transport Committee, Metropolitan-Vickers Electrical Co. Ltd.

Leeds. Supply of lamps for City Transport Dept., for period ending Aug. 31, 1951. Thorn Electrical Industries Ltd.

Northumberland. Installation of electric lighting in two schools at Whitley Bay. Morris and Smiles of Wallsend-on-Tyne.

Watford T.C. Erection and installation of fluorescent lighting in High St. British Thomson-Houston Co. Ltd., £1,008.

Whitley Bay U.D.C. Electrical installation on the Foxhunters' site, Norie Electric Construction Co., £1,166.

Your Queries Answered

"Regina" kettle, makers of? E.B.—Edward Hill and Sons Ltd., Regina Works, Lye, Stourbridge. (19051)

"Pyrotin" fusegear, makers of? N.D.—L. Weekes (Luton) Ltd., Wingate Rd., Luton, Beds. (19056)

"Compton" convector heater, makers of? T.E.—John Compton Organ Co. Ltd., Chase Rd., North Acton, N.W.10. (19062)

"Hitest" cables, makers of? J.R.—Falk Stadelman and Co. Ltd., 91 Farringdon Rd., E.C.1. (19071)

"Frozone" refrigerators, makers of? C.E.—Frozone Ltd., Seamer Rd., Scarborough. (19076)

"Rose" blankets, makers of? S.T.—Sydney A. M. Rose, 19 Park Ave., Old Trafford Manchester 16. (19073)

Machine for covering wire with fabrics, makers of? T.B.—J. B. Hyde and Co. Ltd., Altrincham Rd., Wythenshaw, Manchester; P. Hodges and Co. Ltd., Standard Machine Works, Wells Rd., Nottingham; B. and F. Carter and Co. Ltd., Albion Works, Bolton. (19077)

"Sphere" hairdryer, repairers of? F.S.R.—This hairdryer was made by Marchant Hills and Co. Ltd., a firm which, went out of business in 1939. The Electrical and General Repairs Co., 287 City Rd. E.C.1, undertake repairs. (19079)

The above are selected from questions we have answered this week. If you have a query, send it to us.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, London W.C.2.

Dockman of Cornwall Ltd. Heating, ventilating, electrical, refrigerating, gas, fire protection, cooking and domestic installation engineers, etc. Cap.: £2,000. Dirs.: W. H. Dockman and E. C. York, addresses not stated. Subs.: Barbara G. Brown, 74 Glenthorne Av., Addiscombe, Croydon, and A. Denby.

Ectron Ltd., Reelek Works, Baldock, Herts. Manufacturers of and dealers in electro-medical apparatus, electronic devices, wireless equipment, etc. Cap.: £1,000. Dirs.: Dr. R. J. Russell and Joan A. Russell.

Edgware Refrigeration and Electrical Supplies Ltd., 425 Kingsbury Rd., Kingsbury, N.W.9. Nom. cap. £2,000. Dirs.: F. L. Knowles, H. Lehmann and M. Hurt.

Co. Incorporated Outside G.B.

—Efona Ltd., 55 Welbeck St., W.1. Registered in Dublin in May, 1949. Manufacturers of electric accumulation stores and all other electric instruments and equipment, etc. Cap.: £1,000. Name of person authorised to accept service: R. Brunsden.

TRADE NOTES

Brush Vehicles.—Since 1949 Brush Coachwork, Ltd., have concentrated on the manufacture of the Brush 3-wheeled pony electric vehicles and the industrial truck, and have discontinued their 4-wheeled vehicles. Brush have completed arrangements to ensure service and the supply of spares for all their 4-wheeled vehicles over the next ten years. All surplus components not needed have now been acquired by Hindle, Smart and Co., Ltd., Ardwick, Manchester.

Change of Address.—The Head Office of the National Fire Protection Co., Ltd., has been removed to a site adjoining the factory at Feltham, Middlesex.

The London offices of Woods of Colchester Ltd., are now at 58-62 High Holborn, W.C.1. Telephone: Chancery 5474.

Argentine. — Under a recent Argentine control note circular, 40-W fluorescent tubes and many types of electric lamps, 6/270 V, are excluded from consideration under the terms of a circular providing for the importation of certain goods without using foreign exchange.

PRICES OF CABLE METALS AND OTHER MATERIALS
(at Tuesday evening)

	£ s. d.	New York price
COPPER, electrolytic	202 0 0	£202 0 0
Delivered in 2nd and 3rd month after order	215 10 0	—
Delivered in 4th, 5th and 6th month after order	217 0 0	—
LEAD, good soft pig (foreign)	136 0 0	136 0 0
" " " " "English" quality	137 10 0	—
Delivered in 2nd and 3rd month after order, plus	7 0 0	—
TIN (99-99.75%) (Cash)	1115-1120	—
" (3 months)	985-1000	—
ALUMINIUM, commercial purity (del.)	120 0 0	—
ZINC	151 0 0	140 0 0
ARMOURING:		
Galv. Steel Wire (0.104 in.)	45 10 0	—
Mild Steel Tape (0.04 in.)	26 0 0	—

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Barking Electrical Co., Ltd. Resolution for voluntary winding-up passed at meeting at 11-12 Finsbury Sq., E.C.2, on Nov. 14. Norman W. Osborne, of above address was appointed liquidator.

Dulrae Manufacturing Co., Ltd. Meetings of contributories to be held at West, Wake, Price and Co., 6 Broad St. Place, E.C.2, on Dec. 12, at 11.30 a.m. and 2.30 p.m., to consider conduct of winding-up. Meetings of creditors at same address on Dec. 12 at 11 a.m. and 2 p.m.

Gulf Radiator Co., Ltd. General meeting to be held at 7 Lygon Place, S.W.1, on Dec. 22 at 11 a.m. to receive liquidator's report.

Intended Dividends

London. Philip Myburgh, Ltd., mechanical and electrical engineers, of 797 Commercial Rd., E.14. Last day for receiving proofs, Dec. 6. John M. Clarke, Official Receiver and Liquidator, Inveresk House, Strand, W.C.2.

London. S. B. Jackson, Ltd., electrical and radio engineers of Windsor House, Victoria St., S.W.1. Last day for receiving proofs Dec. 6. Torquil John Murdoch Macleod, 4 Bucklersbury, E.C.4, is liquidator.

Miles Refrigeration, Ltd. Creditors to send particulars to liquidator, Arthur C. Southon, 13 Finchley Lane, Hendon, N.W.4, by Dec. 11.

Schick Dry Shaver (England), Ltd. General meeting to be held at 112-114 Canon St., E.C.4, on Dec. 27 at 11 a.m. to receive liquidator's report.

Tulcan Electrical Industries, Ltd. Meeting of creditors at 67 Wellington Rd. South, Stockport, on Dec. 11 at 10.30 a.m.

Winding-up Order

London. Barwell Electrical Products, Ltd., 255 Earlsfield Rd., Wandsworth, S.W.18. Date of order, Nov. 20.

BANKRUPTCY ACTS

Bury St. Edmunds. Louis Walter Aldis, trading as electrical engineering contractor at Lyndhurst Cottage, Woolpit, Suffolk. Date for receiving proofs Dec. 12. Trustee, Kenneth E. Fisk, Official Receiver, 13a Gt. Colman St., Ipswich.

First Meetings

London. D.B.H. (Engineers), Ltd., heating and electrical contractors of 3 Red Place, Grosvenor Sq., W.1. Creditors and contributories at Room 401, Inveresk House, Strand, W.C.2 on Dec. 6 at 11.30 a.m. and 12 noon respectively.

Sheffield. Reginald L. Lee, trading as Rotherham Electronic Services, electrical, radio and television engineer and neon sign specialist, at 46 Kimberworth Rd., Rotherham. First meeting was at Official Receiver's Office, 55 Queen St., Sheffield, on Nov. 28, and public examination will be at County Court Hall, Bank St., Sheffield, on Jan. 11 at 2.15 p.m.

Voluntary Liquidation

Mid-Cheshire Auto-Electric and Battery Service Ltd., Appleby St., Northwich. Electricians and electrical engineers. At a meeting of creditors it was reported that liabilities amounted to £900. Assets were valued at £801 and after allowing £30 for preferential claims, there were net assets of £771, or a deficiency of £129. Resolution was passed confirming voluntary liquidation, with Mr. Gilbert H. Eaves, of Harry L. Price and Co., 47 Mosley St., Manchester 2, as liquidator.

BUSINESS PROSPECTS

HOME

Atherstone (Warwick) R.D.C. It is proposed to build 50 houses at Mancetter.

Bakewell (Derby) R.D.C. Erection of 38 houses on five sites. Arnold Lowcock, architect, King St., Bakewell.

Barrow-in-Furness T.C. Erection of secondary school in Rating Lane. Borough Engineer and Surveyor, J. N. Flitcroft, Town Hall.

Bishop Auckland U.D.C. Tender amounting to £165,788 has been submitted for approval for erection of 188 houses on Woodhouse Close estate.

Brandon (Durham) U.D.C. Plans approved for erection of 46 houses.

Dunstable T.C. Erection of 44 houses. Borough Surveyor, Municipal Offices, Dunstable.

Dunfermline (Fife) T.C. to erect 254 houses at the Blacklaw site.

Durham. Erection next year of police headquarters at Whickham at estimated cost of £76,000. County Architect is G. R. Clayton, Court Lane, Durham.

Edinburgh. Dean of Guild Court approved plans by University Court for alterations, including installation of lift at the old College, South Bridge, at estimated cost of £5,500.

Glamorgan. Erection of county primary school at Bridgend. County Architect, L. R. Gower, County Hall, Cardiff.

Harrow U.D.C. Erection of 16 bungalows at Pinner. H. W. Rackham, Engineer and Surveyor, Council Offices, Stanmore.

Hartley Wintney (Hants) R.D.C. Plans approved for 16 houses and four bungalows on each of five sites, four houses on each of three sites, three bungalows at Crondall, and six houses at Odiham.

Irthlingborough (Northants) U.D.C. Council to borrow £5,000 for installation of refrigerators in council houses. It is proposed to erect 38 houses on Addington Rd. site.

Keady (Armagh) T.C. Tenders to be invited for erection of 40 houses.

Liverpool. Tenders to be invited for erection of 78 flats at Smithdown La., 54 at Horrocks Av., 12 at Northcote, 18 at Grey St., 8 houses at Cantril Farm, and 4 houses and 30 flats at Marsh Street.

Mablethorpe and Sutton U.D.C. Erection of 30 houses on Kingsley Rd. estate. Watkins, Coombes and Barrell, Heslam Chambers, 191 High St.,Lincoln.

Maidenhead T.C. Erection of 36 houses on Curls Lane estate. C. T. Read, Borough Engineer and Surveyor, 14 Cranford Rise.

Middlesbrough T.C. Tenders being invited for erection of further 86 houses on Berwick Hills site. Engineer is J. A. Kenyon, Municipal Buildings, Gateshead.

Monmouthshire. Erection of infants' school at Tredegar. Colin L. Jones, County Architect, Queen's Hill, Newport, Mon.

Newcastle-on-Tyne. Council to proceed with first stage of five-year programme to install electricity in houses served only by gas. Estimated cost of first stage is £15,825 and of whole programme, £115,924.

Northampton R.D.C. Erection of 32 houses on Duston estate. R. J. Miller, Architect to the Council, 1 Cheyne Walk.

North Riding. Erection of county modern school at Whitby. Architect is A. Graham Henderson, 196 West Regent St., Glasgow C.2. Also plans have been approved for erection of primary schools at Seamer, Eston, Loftus, and Romanby Northallerton next year.

Penge U.D.C. Construction of 38 flats in five blocks on Irenholme estate. Engineer and Surveyor, Town Hall, Anerley Rd., S.E.20.

Portsmouth. Erection of Langstone primary school. City Architect, Western Parade, Portsmouth.

Richmond (Yorks) R.D.C. Tenders being obtained for erection of 34 houses at Catterick and 6 at Skeeby. H. B. Richardson, Council's Architect, 3 Skinnergate, Darlington.

Ripponden (Yorks) U.D.C. Erection of 24 houses on two sites. William Hall, architect, 10 Commercial St., Halifax.

Rugby R.D.C. Erection of 31 houses at Wolston. Council's Surveyor, 24 Warwick St.

Salford. Erection of junior and infants' school in Duke St. Director of Education, Education Office, Chapel St., Salford 3.

Salisbury. Council to apply for sanction to borrow £96,425 for erection of 72 houses on Bemerton Heath estate.

Shaftesbury R.D.C. Construction of 5 houses and 12 bungalows. Council's Architectural Surveyor, J. Hoy, West St., Fontmell Magna, Shaftesbury, Dorset.

Stepney. Plans approved for erection of 40 flats at Jubilee St., and 24 flats at Stepney Way.

Stepney. Construction of 77 dwellings on Vallance Rd. site. Also supply of necessary materials, labour, plant, etc., in 145 houses and flats now being built on Bancroft Rd. site. Borough Engineer and Surveyor, Municipal Offices, Duval St., E.1.

Stretford. Erection of 84 flats on Christie Rd. site. A. H. Perry, Borough Surveyor, Town Hall.

Strood (Kent). R.D.C. has agreed to erect 320 houses on the Hoo Peninsula for Anglo-Iranian Oil Co. employees and Admiralty staff.

West Ashfield U.D.C. Erection of 44 houses at Charing. J. R. Mann, 4 Kingsdown Chambers, Tankerton Circus, Whitstable.

West Bromwich. Erection of 46 houses and flats on Hawthorn estates. H. Schofield, Borough Engineer and Surveyor, Town Hall.

West Hartlepool. Erection of 104 houses on Owton Manor estate. Borough Architect, Municipal Buildings.

OVERSEAS

West Indies. Emtage Electrical Co., Broad St., Bridgetown, would like to receive samples of non-metallic flexible conduit for electric cables.

U.S.A. Radio Laboratories, 1612 Grand Ave., Kansas City, urgently require 300 ohm transmission line or cable and 85 mm. Polyethelene with two No. 20 conductors. Interested firms should contact Mr. Bob Smith, general manager.

Also A. J. Perez Export Co., 305 International Trade Mart, New Orleans 12 are interested in representing U.K. manufacturers of radio equipment in Latin American countries.

We have been asked to point out that Mr. H. M. Desai, mentioned in connection with the Indian company of Union Conduits, Ltd., in our Nov. 16 issue, is representing the firm and acting on their behalf, but is not a member of their staff.

MEETINGS TO NOTE

THURSDAY, NOV. 30

ELECT. POWER ENGRS. ASSOC. (Midland Tech. Group).—"Busbar Zone Protection." H. Hurst. Northampton. 7 p.m.

I.E.S. (Nottingham Centre).—Presidential address. L. J. Davies. Gas Showrooms, Parliament St. 5.30 p.m.

I.E.S. (Exeter Group).—"Lighting in the Home." Miss M. Wardlaw. Agricultural House, Queen St. 7 p.m.

I.E.E. (S.W. Sub-centre).—"Planning of an Electricity Board's Distribution System." G. O. McLean. Rougemont Hotel, Exeter. 3 p.m.

LEEDS ASSOC. OF ENGRS.—"Manufacture of Television Cathode Ray Tubes." T. D. Humphreys. Hotel Metropole, Leeds. 7 p.m.

A.S.E.E. (Luton Branch).—"Power Factor Correction and Power Capacitors." James Orr and A. E. Waller. George Hotel. 8 p.m.

FRIDAY, DEC. 1

I.E.S. (Bath and Bristol Centre).—"Lighting in the Home." Miss M. D. Wardlaw. Grand Hotel, Bristol. 7 p.m.

I.E.S. (Birmingham Centre).—"Floodlighting." R. O. Ackerley. Imperial Hotel, Temple St. 6 p.m.

I.E.S. (Huddersfield Group).—"Illuminated Signs and Display with Discharge Tubes." C. Higgins. Elect. Showrooms, Market St. 7.15 p.m.

MANCHESTER ASSOC. OF ENGRS.—"Engineering Aspects of Film Production." R. Howard Cricks. Engrs' Club, Albert Sq. 6.45 p.m.

I.E.E. (N.E. Students' Section).—A Smoker at Bridge Hotel, Castle Sq., Newcastle. 7.30 p.m.

MONDAY, DEC. 4

I.E.E. (N.E. Centre).—Annual dinner and dance. Old Assembly Rooms, Westgate Rd., Newcastle. 7 p.m.

I.E.E. (N.E. Radio Group).—"A Simplified Method for Checking the Orientation of the Optic Axis of Meter Jewels," and "A Sensitive Balance for Stability Tests on Permanent Magnets." S. F. Knight. King's College, Newcastle. 6.15 p.m.

I.E.S. (Leeds Centre).—"Light and the Eye." W. J. Wellwood Ferguson. 24 Aire St., Leeds. 7 p.m.

I.E.S. (Liverpool Centre).—"Specialised and General Lighting in Hospitals." M. W. Peirce and D. J. Reed. Merseyside and N. Wales Elect. Board, Whitechapel, Liverpool. 6 p.m.

I.E.S. (Sheffield Centre).—"Control Gear for Fluorescent Lamps." S. Anderson. University, Weston Bank. 6 p.m.

INSTN. OF HEATING AND VENTILATING ENGRS. (Liverpool Branch).—"Soil Warming by Electricity." E. Covington. Radiant House, Bolt St. 6.30 p.m.

INSTN. OF HEATING AND VENTILATING ENGRS. (Manchester Branch).—Annual dinner at Denmark Hotel.

I.E.E. (Maidstone).—"Aerial Cables for Telecommunication Purposes." A. G. Robins. New Inn, Sandling Rd. 7.30 p.m.

I.E.E. (Norwich).—"Electricity in the Cotton Industry." F. W. Cox and W. E. Swale. 7.30 p.m.

I.E.E. (Mersey and N. Wales Centre).—"Review of Research in Electricity Supply." C. W. Marshall. Liverpool Royal Instn., Colquitt St. 6.30 p.m.

I.E.E. (S. Midland Centre).—"Generation and Flow of Harmonics in Transmission Systems." S. Whitehead and W. G. Radley. James Watt Memorial Inst., Gt. Charles St., Birmingham. 6 p.m.

A.S.E.E. (Leeds Branch).—"Electricity on Farms." J. Hack. Gt. Northern Hotel, Wellington St. 7.30 p.m.

A.S.E.E. (N.E. London Branch).—"Hot Cathode Lighting." D. E. Mutch. Angel Hotel, Ilford. 8 p.m.

A.S.E.E. (Sheffield Branch).—"Modern Airfield Hangar Installations." S. Ramsden. Royal Victoria Hotel. 7.30 p.m.

TUESDAY, DEC. 5

INSTN. OF WORKS MANAGERS (Leicester Branch.)—"Operator Training." S. R. Baxter, of B.T.H. Co. College of Technology. 7 p.m.

I.E.E. (Cambridge Radio Group).—"Review of Television Pick-up Tubes." J. D. McGee. "Design of a Television Camera Channel for use with C.P.S. Emitron." E. L. C. White and M. G. Harker. Cambridgeshire Tech. College. 6 p.m.

I.E.E. (N.W. Utilisation Group).—"Evolution of the Lighting Art." J. W. T. Walsh. Engineers Club, Albert Sq., Manchester. 6.15 p.m.

A.S.E.E. (W. London Branch).—"Problems of Large Store Electrical Installations." A. W. Jervis. Hammersmith Town Hall. 7.30 p.m.

A.S.E.E. (N.W. London Branch).—"Radio Interference Suppression." H. Andrews. St. Hilda's Hall, Northolt Rd., S. Harrow. 7.45 p.m.

WEDNESDAY, DEC. 6

I.E.S. (Newcastle Centre).—"Notes on Industrial Lighting." W. Imrie-Smith. Minor Durrant Hall, Oxford St., Newcastle. 6.15 p.m.

I.E.S. (Swansea Group).—"Stage Lighting." E. Faraday. 4 Northampton Gdns. 5.45 p.m.

INSTN. OF HEATING AND VENTILATING ENGRS.—"Heating by means of Tetra-Cresye Silicate." R. A. Rose. Instn. of Mechanical Engrs., Storey's Gate, S.W.1. 6 p.m.

INSTN. OF HEATING AND VENTILATING ENGRS. (E. Midlands Branch).—"Aspects and Developments in School Heating." C. A. Reynard and E. Goring. School of Technology, Leicester. 6.30 p.m.

I.E.E. (London Radio Section).—"Crystal Diodes." R. W. Douglas and E. G. James. "Crystal Triodes." T. R. Scott. Savoy Place, W.C.2. 5.30 p.m.

I.E.E. (Tees-Side Sub-centre).—"Education and Training of Electrical Technicians." K. R. Evans. Cleveland Scientific and Tech. Inst., Middlesbrough. 6.30 p.m.

I.E.E. (Southern Centre).—"Some Experience with a British A.C. Network Analyser." G. Lyon. British Elect. House, 111 High St., Portsmouth. 6.30 p.m.

A.S.E.E. (N. London Branch).—"Design and Operation of Electric Water-heating and Space-warming Installations." F. Grant. Three Jolly Butchers Hotel, Wood Green, N.22. 8.15 p.m.

A.S.E.E. (S.E. London Branch).—"High Frequency Heating and Processing." J. Wharton. S.E. London Tech. College, Lewisham. 8 p.m.

A.S.E.E. (York Branch).—"Fractional h.p. Motor Progress." C. A. G. Martin. Royal Station Hotel. 8 p.m.

THURSDAY, DEC. 7

INSTN. OF WORKS MANAGERS (Bristol Branch).—"Sales and Marketing." Royal Hotel. 7.15 p.m.

WOMEN'S ENGRNG SOC.—"The Festival Concert Hall." 35 Grosvenor Pl., S.W.1. 7 p.m.

BRIT. INSTN. OF RADIO ENGRS. (Scottish Section).—"Vacuum Engineering as applied to Electronics." D. Latham. Heriot Watt Coll., Edinburgh. 6.45 p.m.

BRIT. INSTN. OF RADIO ENGRS. (N.W. Section).—"High Fidelity Reproduction." H. J. Leak. Coll. of Technology, Manchester. 6.45 p.m.

I.E.E. (London).—"Control of Hydro-Electric Plant." A. C. H. Frost and W. Brittlebank. Savoy Pl., W.C.2. 5.30 p.m.

I.E.E. (E. Midland Centre).—Faraday Lecture: "Lamps and Lighting: Record of Industrial Research." L. J. Davies. Albert Hall, Nottingham. 7.15 p.m.

A.S.E.E. (S. London Branch)—"Prevention of Electrical Accidents, II." Col. Emerson, Inspector, Min. of Labour and National Service. Cafe Royal, North End, Croydon. 8 p.m.

FRIDAY, DEC. 8

A.S.E.E. (Bristol Branch).—"Mineral Insulated Cables." A. H. Dyer. Grand Hotel. 7.30 p.m.

A.S.E.E. (Crewe Branch).—"The I.E.E. Regulations (12th edition)." H. Neville and R. Nicholls. Crewe Arms Hotel. 7.30 p.m.

A.S.E.E. (Nottingham Branch).—"Mineral Insulated Copper-covered Cable." G. Gilchrist. Elect. Showrooms, Smithy Row. 7.30 p.m.

I.E.E. (N.E. Students Section).—"Switchgear for E.V.H. Transmission." R. W. Gee. King's College, Newcastle. 6.30 p.m.

I.E.S. (Cardiff Centre).—"Stage Lighting." E. Faraday. S. Wales Elect. Board, The Hayes. 5.45 p.m.

INSTN. OF HEATING AND VENTILATING ENGRS.; (Birmingham Branch). Annual dinner. Midland Hotel.

I.E.E. (London Education Circle).—Discussion on "How best to introduce the *ab initio* Use of the M.K.S. System to Students." Savoy Pl., W.C.2. 6 p.m.

I.E.E. (S. Midland Centre).—"Brabazon Aircraft." A. E. Russell. James Watt Memorial Inst., Gt. Charles St., Birmingham. 6 p.m.

VARIABLE SPEED MACHINE DRIVES

with *Hewittic* VELOTROL *Rectifiers*

HEWITTIC Velotrol rectifiers provide the ideal means of achieving exceptionally wide range, positive fine speed control of motor driven machinery.

Hackbridge and Hewittic Electric Company Ltd. can offer, from wide experience, static conversion equipment using modern electronic or electro-magnetic control systems providing manual or automatic operation.

Send us details of your problems.

Illustrated above: Hewittic Velotrol rectifier operating a 54" diameter Horizontal Bull Block for drawing tubes, driven by a 75 h.p. variable speed D.C. motor. (Courtesy: Marshall Richards Machine Co. Ltd.) also a typical Velotrol rectifier installation powering variable speed machinery.

HACKBRIDGE AND HEWITTIC ELECTRIC CO. LTD., WALTON-ON-THAMES, SURREY

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Light Gauge Tube

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CONDUIT TUBE & FITTINGS

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THE METALLIC SEAMLESS TUBE Co. Ltd., Ludgate Hill, BIRMINGHAM 3. Tel. CEN 7167
Also at London, Newcastle-on-Tyne, Leeds, Swansea and Glasgow

CLASSIFIED ADVERTISEMENTS

OFFICIAL TENDERS AND APPOINTMENTS

WANTED · FOR SALE WORK WANTED

Those wishing to advertise in these pages should send the text to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia St., W.C.2, before 10 a.m. on TUESDAY of week of issue. Official Displayed Advertisements are charged at 35s. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted will be published four times for twice the single insertion rate. Fee for Box No. and postage on replies is 2s.

TENDERS INVITED

CITY OF WINCHESTER

Garnier Road Pumping Station

SUPPLY AND ERECTION OF DIESEL ENGINES AND ELECTRIC MOTOR

THE Corporation invites Tenders for the supply and erection of two Diesel Engines (each 100 h.p.) and a variable speed electric motor (100 h.p.) for driving three existing pump sets. Specifications and Forms of Tender, which will be issued separately for the two types of machinery, may be obtained from the City Engineer, Guildhall, Winchester.

Tenders endorsed "ENGINES (MOTOR), GARNIER ROAD" in plain sealed envelopes, must be delivered to the undersigned not later than Thursday, December 28, 1950.

R. H. McCALL,
Town Clerk.

The Guildhall,
Winchester. (G 795)

HASLEMERE URBAN DISTRICT COUNCIL

CONVERSION OF PUMPS FROM DIESEL TO MOTOR DRIVEN

THE above Council invite tenders for the supply and installation of an electric motor of approximately 60 b.h.p. to drive a multi-stage centrifugal pump, together with starting and automatic control gear, at Sturt Road Water Pumping Station, Haslemere, Surrey.

Specification, conditions of contract and form of tender may be obtained from the Engineer and Surveyor to the Council at the address given below.

Sealed tenders, endorsed "Pump Conversion," to be received by me not later than noon on December 30, 1950.

The lowest or any tender will not necessarily be accepted.

V. L. MORGAN,
Clerk of the Council.

Council Offices, Museum Hill,
Haslemere, Surrey.
November 27, 1950. (G 811)

APPOINTMENTS VACANT

SOUTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF SUB-AREA SENIOR DEMONSTRATOR

APPLICATIONS are invited from suitably qualified and experienced persons for the position of Senior Demonstrator for the Taunton Sub-Area, with Offices at Taunton, Somerset, at a commencing salary of £450 per annum within Grade 3 (£450 by 20 to £510) of the N.J.C. Salary Agreement. The person appointed will be responsible for the recruitment and training of staff; co-operation with appropriate officers at Sub-Area; policy and planning exhibitions; agricultural shows; contact with educational authorities and women's organisations. Applicants must have had a good general education and possess a recognised Domestic Science qualification and the E.A.W. Housecraft Certificate. They must be capable of giving lectures and demonstrations in service centres and on consumers' premises, and to advise on the selection and use of electrical apparatus.

Applications, giving age, present position, salary, and details of qualifications and experience, should be submitted to L. V. Turner, Sub-Area Manager, Taunton Sub-Area, Electricity House, The Parade, Taunton, within ten days. (G 802)

BRITISH BROADCASTING CORPORATION

B.B.C. invites applications for a post of ENGINEER in the Power Section, Planning and Installation Department, London. The section deals with a wide variety of electrical plant including switchgear, transformers, rectifiers, a.c. and d.c. motors and generators, diesel alternators, contactor and control gear, batteries, cables, etc. Applicants should possess a degree in electrical engineering (or equivalent qualification), and have wide experience in the above field. They should preferably have served an apprenticeship with a large manufacturing concern, and have had subsequent experience of site erection and commissioning, including the preparation and execution of h.v. cable contracts. Starting salary £745 (may be higher if qualifications and experience are exceptional), rising by annual increments, on a five years' progression, to £965 p.a. The successful applicant will become eligible for consideration for appointment to established staff (contributory pension scheme) after two years' qualifying period.—Applications, stating age, qualifications, and details of past and present employment, should reach Engineering Establishment Officer, Broadcasting House, London W.1, within seven days. (G 792)

BRITISH ELECTRICITY AUTHORITY

South East Scotland Division

TECHNICAL CHEMIST

APPLICATIONS are invited for the appointment of a Technical Chemist. Pending grading under the revised N.J.B. Agreement, the commencing salary will be within the range £752-£911, dependent upon qualifications and experience.

Applicants should have a first-class degree in Technical Chemistry with some subsequent industrial experience. An important part of the work will be the chemical analysis and control of feed water supply to high-pressure, high-temperature P.F. steam boilers, and the chemical analysis and quality control of fuel. Some knowledge of corrosion chemistry, metallurgy and metallography as applied to steel alloys for high-temperature steam power purposes would be an advantage.

The appointment will be superannuable under the terms and conditions of the Authority's Superannuation Scheme.

Applications, stating age, qualifications and experience, should be addressed to the Divisional Controller, British Electricity Authority, South East Scotland Division, British Electricity House, Portobello, Midlothian.

J. F. FIELD,
Divisional Controller.
(G 790)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

ASSISTANT ELECTRICAL ENGINEER

APPLICATIONS are invited for the position of Third Assistant Engineer (Electrical) in the Generation Construction Department at this Divisional Headquarters. Applicants should have experience in switchgear, electrical auxiliaries, main and multicore cablework, lighting and heating of large power stations, and should possess a degree or equivalent in electrical engineering.

The salary for this appointment will be in accordance with Grade 5 of Schedule C of the National Joint Board Agreement (£579-£776 per annum) and will commence at a point within the scale according to qualifications and experience. The position is superannuable within the provisions of the British Electricity Authority and Area Boards' Superannuation Scheme.

Applications should be submitted on the official form which may be obtained from the Divisional Establishments Officer, British Electricity Authority, Barker Gate, Nottingham and should be returned not later than December 12, 1950.

W. S. BURGE,
Divisional Controller.

British Electricity House,
Barker Gate, Nottingham. (G 734)

PROFESSIONAL ENGINEERS IN GOVERNMENT DEPARTMENTS

THE Civil Service Commissioners announce an Open Competition to be held during 1950 for permanent appointments of Professional Engineers in many Departments of the Civil Service for a wide variety of engineering duties. Applications will be accepted at any time before 31st December, 1950, and selected candidates will be interviewed as soon as possible after the receipt of their application forms. Candidates are advised to apply as early as possible.

AGE LIMITS: Candidates must be under 35 on 30th November, 1950, with extension for regular service in H.M. Forces and for established Civil Service. For appointments in the Post Office they must be 21 or over, in the Ministry of Supply and the Ministry of Civil Aviation 23, and in all other Departments 25 or over on that date.

MINIMUM QUALIFICATIONS vary for different posts. Generally, a University degree in Engineering or Corporate Membership of the Institution of Mechanical Engineers, Electrical Engineers or Civil Engineers, or exemption from Sections A and B of the corresponding Associate Membership examinations, or evidence of exceptionally high professional attainment are required. For certain posts, Corporate Membership of the Institute of Fuel by examination or the Institution of Chemical Engineers, or Graduate Membership of the Institution of Chemical Engineers, or Associate Fellowship of the Royal Aeronautical Society or an Honours degree in Physics or Engineering will be accepted instead.

The salary on appointment will be fixed according to age. The salary for men aged 26 in London is £500, rising by annual increments of £25 to £750. Salaries for women and for posts outside London are lower. There are prospects of promotion to higher grades on scales for men in London of £750-£1,000, £1,050-£1,270, and above.

Further particulars and application forms from Secretary, Civil Service Commission, Trinidad House, Old Burlington Street, London W.1, quoting No. 3225. (G 791)

BRITISH ELECTRICITY AUTHORITY

South Western Division

MECHANICAL MAINTENANCE ENGINEER—PORTISHEAD POWER STATION

APPLICATIONS are invited for the position of Mechanical Maintenance Engineer at Portishead Power Station. Candidates should have had a wide experience in the maintenance of generating station power plant and should be capable of organising and taking control of a large maintenance staff, machine shop, and supervising turbine and boiler overhauls. Candidates should preferably be Corporate Members of the Institution of Electrical or Mechanical Engineers, or possess equivalent qualifications.

Salary and conditions of service will be in accordance with the National Joint Board Agreement, Class "J," Grade 6, £799-£933 per annum. The appointment will be superannuable in accordance with the British Electricity Authority and Area Boards Superannuation Scheme.

Application stating age, qualifications, experience, present appointment and salary should be addressed to the Divisional Secretary, British Electricity Authority, South Western Division, British Electricity House, 26 Oakfield Road, Bristol 8, so as to be received not later than December 15, 1950.

R. C. BARRETT,
Divisional Secretary.

November 24, 1950. (G 805)

SINGAPORE MUNICIPALITY

ELECTRICITY DEPARTMENT

CHARGE ENGINEERS. Permanent Staff, required for shift duties in the Singapore Power Station. Present capacity, 37,000 kW, with proposed extensions to 87,000 kW.

Experience of extra high-tension 3-phase generation in a modern high-pressure steam power station is essential. Appointment subject to medical examination.

Basic salary scale, $440-$870 per month. Starting point according to qualifications and experience. Graduated scale of allowances, e.g., present allowance on $560 p.m. basic salary amounts to: Expatriation $110 p.m., plus cost of living $192 p.m. for single man or $246 p.m. for married man, or $318 p.m. for married man with family. Annual increments, $30 p.m. Local taxation much lower than in England. One Straits dollar equals 2s. 4d. Thus a married man with family on basic salary of $560 would draw equivalent of £1,383 sterling per annum.

Quarters, with heavy furniture, provided at 8 per cent. of salary or housing allowance up to 12 per cent. in lieu. Initial engagement on three years' agreement; eight months' leave after four years' service. Free medical attention. Passages paid, including family. Compulsory provident fund contribution, 7½ per cent. of salary, and Municipal Commissioners donate 7½ per cent. for first 10 years, rising to 20 per cent. after 20 years' service.

Applications, in duplicate, with full personal and technical information and copies of three testimonials to Messrs. Peirce and Williams (agents to the Municipal Commissioners), 1 Victoria Street, London, S.W.1. (G 661)

CITY OF SALISBURY (SOUTHERN RHODESIA)

Electricity Department

VACANCY FOR SWITCHBOARD ATTENDANTS
SALARY GRADE £583 4s. BY £36 TO £691 4s.

APPLICANTS should have completed a technical education to the standard of graduate of the Institution of Electrical Engineers and must have had experience in the operation of Power Station plant including control room duties (preferably on an interconnection system) and the running up of steam turbine plant.

The appointment is subject to Council's Service and leave regulations, which will be made available for inspection by selected candidates at the office of the undersigned. The salary payable will be in accordance with the above salary grade, plus a cost-of-living allowance at present fixed at approximately 10 per cent. of the basic salary and children's allowances where applicable.

The successful candidate must be able to comply with the regulations of the Southern Rhodesia Immigration Authorities and will be required to submit a satisfactory medical certificate of fitness.

Applicants, who should be not more than 35 years of age, are requested to submit full particulars of their qualifications, training and experience, giving details of positions held and salaries received, marital state, age, place of birth and nationality. Copies of not more than three recent testimonials may be included.

Canvassing, directly or indirectly, will be a disqualification.

Applications, suitably endorsed on the cover, must reach the office of the undersigned on or before the 22nd December, 1950. Airmail paper should be used.

DAVIS & SOPER, LTD.,
Agents to the City Council of Salisbury,
52 and 54 St. Mary Axe, London, E.C.3.
November 20, 1950. (G 773)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:

Norfolk Sub-Area

THIRD ASSISTANT ENGINEER 86/50

Applicants should preferably be Graduate Members of the Institution of Electrical Engineers or possess equivalent qualifications. The duties are concerned mainly with the commissioning, routine testing and general supervision of protective gear on networks up to and including 33kV, a large proportion of which are protected by arc suppression coils, and the carrying out of pressure tests and other special tests as occasion may arise. A knowledge of radio and telephone equipment, though not essential, would be an advantage.

The post is graded Class "H," Grade 10, £571, in accordance with the N.J.B. Agreement (revised). Applications should be addressed to: The Manager, Norfolk Sub-Area, Eastern Electricity Board, 4 Duke Street, Norwich.

Fens Sub-Area

DEMONSTRATOR ST. IVES 120/50

Applicants should have had Domestic Science training, including electrical housecraft, and should be competent to plan and give cookery demonstrations, including lectures and advice to consumers on the utilisation of electrical appliances. Previous experience in an Electricity Service Centre is desirable. The salary will be in accordance with Grade 1, £310 by £20 to £390, of the National Joint Council Agreement dated March 23, 1950.

Applications should be addressed to: The Manager, Huntingdon District, Electricity Offices, St. Neots, Hunts.

Both future salaries and conditions of service will be in accordance with agreements made from time to time by the appropriate negotiating bodies. The successful candidates will be required to contribute to a superannuation scheme, and may be required to pass a medical examination.

Applications in writing, stating age, qualifications, experience, details of present employment and salary, together with the names of two referees should be addressed to the Managers concerned so as to arrive not later than 14 days from the appearance of the notice. (G 806)

SOUTH EASTERN ELECTRICITY BOARD

Kent Sub-Area

AUDIT ASSISTANT

SALARY £450 by £20 to £510 under the N.J.C. Agreement, Grade 3. Applicants should have a thorough experience of auditing or accounting in the electricity industry. The passing of the intermediate examination of a recognised accountancy body will be considered an advantage.

Applications, giving two references, must reach H. F. Knell, Esq., J.P., M.I.E.E., Kent Manager, South Eastern Electricity Board, 179-184 High Street, Rochester, Kent, by December 11, 1950.

A. L. BURNELL,
Secretary.

November 1950. (G 803)

YORKSHIRE ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:—

No. 1 (Bradford) Sub-Area

INSTALLATION ENGINEER (Otley District). Vacancy No. 65/50.

INSTALLATION ENGINEER (Keighley District). Vacancy No. 79/50.

Applicants must have had a sound technical and practical training, and be capable of preparing and supervising schemes for all classes of domestic, commercial and industrial installations, including specifications, estimates and tenders.

Salaries:—N.J.B. Agreement, Class "E," Grade 8, £550/£560 per annum.

HOUSECRAFT ADVISER. Vacancy No. 65/50.

Applicants should have had training in a Domestic Science College and in addition be in possession of the E.A.W. Certificate for Demonstrators. They should also have had considerable experience in advising on the use of electrical appliances in the home and in giving public demonstrations of such appliances, and be capable of organising and supervising the Housecraft Advisory Service and public demonstrations in the Sub-Area. Experience in large scale cooking will be an advantage.

Salary:—N.J.C. Agreement, Grade 3, £450/£20/£510 per annum.

Applications, stating the above vacancy numbers, and giving full details of age, qualifications, and experience, should be forwarded to the Manager, No. 1 (Bradford) Sub-Area, Yorkshire Electricity Board, 45-53 Sunbridge Road, Bradford, within fourteen days of the appearance of this advertisement.

No. 4 (Leeds) Sub-Area

THIRD ASSISTANT ENGINEER (MEASUREMENT). Vacancy No. 73/50.

Applicants should be Corporate Members or Graduates of the Institution of Electrical Engineers or possess equivalent qualifications, and should have a sound knowledge of automatic protective gear with some experience in the commissioning and maintenance of equipment. Experience of high voltage testing and high voltage cable fault location will be an advantage.

The successful candidate will be required to undertake standby duties for high voltage fault location.

Salary: N.J.B. Agreement, Class "J", Grade 10, £609/£633 per annum.

Applications, stating the above vacancy number, and giving full details of age, qualifications, and experience, should be forwarded to the Manager, No. 4 (Leeds) Sub-Area, Yorkshire Electricity Board, 1 Whitehall Road, Leeds, within 14 days of the appearance of this advertisement.

No. 5 (Wakefield) Sub-Area

GENERAL ASSISTANT ENGINEER (Wakefield District). Vacancy No. 87/50.

Applicants should have had experience in a large undertaking employing h.v. and l.v. underground mains, experience in fault location, supervision of jointing, cable laying and the erection of overhead lines would be an advantage.

Applicants should be able to drive a car.

Salary: N.J.B. Agreement, Class "F", Grade 11, £482/£498 per annum.

Applications, stating the above vacancy number, and giving full details of age, qualifications, and experience, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Road, Wakefield, within 14 days of the appearance of this advertisement.

No. 6 (Hull) Sub-Area

FIRST ASSISTANT DISTRICT ENGINEER (Hull District). Vacancy No. 84/50.

The engineer appointed will be required to assist the District Engineer in all work in connection with the district organisation.

He must have had a wide experience in the design, construction, operation, and maintenance of h.v. and l.v. underground and overhead distribution networks, including substation equipment, and should be capable of preparing complete schemes, reports and estimates in connection with all types of extensions. Applicants should be Corporate Members of the Institution of Electrical Engineers, or hold exempting qualifications.

The successful applicant will be required to reside in Hull.

Salary: N.J.B. Agreement, Class "H", Grade 4, £878/£918 per annum.

FIRST ASSISTANT DISTRICT ENGINEER (Goole District). Vacancy No. 72/50.

Applicants should be experienced in the design, construction, operation, and maintenance of h.v. and l.v. overhead and underground distribution networks, substation plant and ancillary apparatus.

The successful applicant will be responsible to the District Engineer, and must be capable of preparing complete schemes and estimates. He will be required to reside in the Goole district and undertake standby duty.

(*Continued in next column*)

(*Continued from previous column*)

Applicants should be Corporate Members of the Institution of Electrical Engineers or possess equivalent qualifications.

Salary: N.J.B. Agreement, Class "D", Grade 5, £641/£655 per annum.

Applications, stating the above vacancy numbers, and giving full details of age, qualifications, and experience, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, within 14 days of the appearance of this advertisement.

No. 7 (Grimsby) Sub-Area

SECOND ASSISTANT DISTRICT ENGINEER (Grimsby District). Vacancy No. 47/50.

Applicants must have had a sound practical training and considerable experience in the operation, maintenance, planning, and construction of high and low voltage underground and overhead networks, substation plant, and ancillary apparatus. Preference will be given to candidates who are Corporate Members of the Institution of Electrical Engineers, or who hold an engineering degree, or equivalent qualification.

Salary: N.J.B. Agreement, Class "E", Grade 7, £579/£609 per annum.

THIRD ASSISTANT ENGINEER (Distribution Design) Vacancy No. 85/50.

Applicants must have had a sound practical training and experience in the operation, maintenance, planning and construction of high and low voltage underground and overhead networks, substation plant and ancillary apparatus. Preference will be given to candidates who hold an engineering degree or equivalent qualification.

Salary: N.J.B. Agreement, Class "G", Grade 10, £539/£561 per annum.

LINESMEN (OVERHEAD POWER). Vacancy No. 80/50.

Applicants should be experienced in the construction and maintenance of high voltage steel mast and wood pole lines and associated equipment.

Wages and conditions of service in accordance with the N.J.I.C. Agreement for the Electricity Supply Industry, the present rate of pay being 34.00d. per hour for a 44-hour 5-day week.

FITTERS (ELECTRICAL). Vacancy No. 80/50.

Applicants should be fully experienced in the erection and maintenance of high voltage outdoor and indoor switchgear transformers and associated apparatus.

Wages and conditions of service in accordance with the N.J.I.C. Agreement for the Electricity Supply Industry, the present rate of pay being 35.00d. per hour for a 44-hour 5-day week.

Applications, stating the above vacancy numbers, and giving full details of age, qualifications, and experience should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Road, Grimsby, within 14 days of the appearance of this advertisement. (G 777)

BRITISH ELECTRICITY AUTHORITY

Southern Division

APPLICATIONS are invited for a vacancy in each of the following sections of the Technical Engineer's Department for a GENERAL ASSISTANT ENGINEER.

(a) Protective Gear
(b) Metering
(c) System Development

The terms and conditions of employment will be those approved by the National Joint Board, and the salary will be in accordance with Grade 8 of the Schedule, namely £437-£586 per annum. Candidates should have had appropriate experience of technical work in one or more of the sections mentioned. Candidates should either possess technical qualifications and experience admitting to corporate membership of the Institution of Electrical Engineers or equivalent, or be studying for the examinations of the Institution.

Forms of application may be obtained from the undersigned and must be returned by December 15, 1950.

P. D. A. OLIVER,
Divisional Secretary.

British Electricity House,
High Street,
Portsmouth (G 800)

BRITISH ELECTRICITY AUTHORITY

Merseyside and North Wales Division

APPLICATIONS are invited for the appointments of GENERAL ASSISTANT ENGINEER (PROTECTION) in the Technical Department at Divisional Headquarters, Liverpool. Salary £437/£569 being Class "AX", Grade 8, of the N.J.B. Schedule.

Applicants should have passed the Higher National Certificate in Electrical Engineering and have practical experience in the testing of e.h.v. switchgear installations, site-testing of relay and control circuits or relay testing and adjustment in manufacturers' works.

The appointment is superannuable under the British Electricity Authority and Area Boards' Superannuation Scheme and subject to a medical examination.

Forms of application may be obtained from the Divisional Secretary, Clarke Gardens, Wooiton, Liverpool, and should be returned to him not later than Monday, December 11, 1950. (G 812)

BRITISH ELECTRICITY AUTHORITY

Southern Division

APPLICATIONS are invited for the following vacancies within the Division.

1. ASSISTANT CHEMIST, PORTSMOUTH GENERATING STATION.

Provisional salary £506-£528 p.a. Applicants should have had practical experience of fuel, water, and oil testing appropriate to modern generating stations. A knowledge of boiler chemistry for high steam pressures and temperatures will be an advantage. Preference will be given to candidates possessing a Higher National Certificate in Chemistry or equivalent qualifications.

2. ASSISTANT CHEMIST, SOUTHAMPTON GENERATING STATION.

Provisional salary £482-£496 p.a. Qualifications and experience should be similar to those for post 1 above.

3. JUNIOR CHEMIST, SWINDON GENERATING STATION.

Provisional salary £375 p.a. Applicants should have had some experience in the testing and analysis of fuel, water and oil, and have qualifications at least equivalent to an inter B.Sc.

4. LABORATORY ASSISTANT, EARLEY GENERATING STATION

Wage 2s. 11d. per hour. The duties will include routine work in connection with sampling and testing of water and fuels. Candidates should have a sound general education and preference will be given to applicants working for a recognised examination.

All the appointments may be subject to a satisfactory medical examination, and posts 1, 2 and 3 are superannuable. Application forms may be obtained from the undersigned and must be returned by December 15, 1950.

P. D. A. OLIVER,
Divisional Secretary.

British Electricity House,
High Street,
Portsmouth. (G 801)

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointment in the Technical (Electrical) Department at Divisional Sub-Headquarters, West Farm Place, Cockfosters:—

GENERAL ASSISTANT ENGINEER (Metering Section)

The duties of the post will be assisting with metering and general technical work.

Applicants should be Graduate or Corporate Members of the Institution of Electrical Engineers, and have had experience in metering and or protective gear equipment, in addition to an engineering works training.

Salary range in accordance with the Revised N.J.B. Agreement, Schedule "C," Grade 8, Class "AX.CX" £437-£604 per annum (plus London Weighting).

The commencing salary will depend upon qualifications and experience.

The appointment will be superannuable in accordance with the British Electricity Authority and Area Boards' Superannuation Scheme.

Forms of application may be obtained from the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, to whom completed forms should be sent to arrive not later than December 15, 1950. Envelopes should be endorsed "General Assistant Engineer (Metering Section)."

W. N. C. CLINCH,
Controller.

Northmet House,
Southgate, N.14. (G 809)

NORTH WESTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments in the Construction Section of the Chief Engineer's Department at Area Board Headquarters, Cheetwood Road, Manchester 8:—

THIRD ASSISTANT (MAINS)

Candidates should have had experience in the design, construction, erection and or laying of low voltage and high voltage overhead lines and underground cables, including field survey work. A specialised knowledge in the design and construction of 33 kV overhead lines will be an added recommendation.

THIRD ASSISTANT (SUB-STATIONS).

Candidates should have had experience in the handling of switchgear, transformers and other substation equipment contracts including the examination of tenders and the checking of drawings and diagrams, together with experience in the design and layout of substations, both indoor and outdoor up to and including 33 kV equipment. Preference will be given to candidates who possess an engineering degree or the Higher National Certificate in Electrical Engineering.

The salary for each appointment will be in accordance with the National Joint Board Revised Schedule, and within the range of Class "AX.DX", Grade 5, i.e. £579-£776 per annum.

Applications, stating age, qualifications and experience, present post and salary, should be received by the Establishment Officer, The North Western Electricity Board, Cheetwood Road, Manchester 8, not later than Saturday, December 16, 1950. (G 813)

SOUTHERN ELECTRICITY BOARD

No. 1 (Southall) Sub-Area

BRACKNELL DISTRICT

APPLICATIONS are invited for the post of DISTRICT COMMERCIAL OFFICER.

Qualifications.—Applicants must have had considerable experience in the commercial side of the Electricity Supply Industry, especially in relation to rural development. They should possess a good knowledge of tariffs, sales, commercial statistics, electrical contracting and all aspects of consumer service.

Salary and Conditions of Service.—Salary in accordance with N.J.B., Class "E," Grade 4 (£722-£737-£752) with N.J.B. conditions of service. The successful candidate will be required to contribute to the B.E.A. and Area Boards' Superannuation Scheme if eligible.

Applications.—On a standard form obtainable from the Sub-Area Secretary and returned to him at No. 2/6 Windmill Lane, Southall, not later than fourteen days after the appearance of this notice.

F. W. KEMPTON,
Secretary.
(G 774)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

APPLICATIONS are invited for the position of GENERAL ASSISTANT ENGINEER (Construction) in the Generation Construction Department. Applicants must hold the Higher National Certificate in Mechanical and or Electrical Engineering, or be corporate members of the I.E.E. or I.Mech.E., and should preferably have had workshop training. Salary and conditions of service will be in accordance with the National Joint Board Schedule, Class "AX" (8) commencing at £437 per annum. The post is superannuable within the provisions of the British Electricity Authority and Area Boards' Superannuation Scheme.

Forms of application, which may be obtained from the Divisional Establishments Officer, British Electricity Authority, British Electricity House, Barker Gate, Nottingham, should be returned not later than December 12, 1950.

W. S. BURGE,
Divisional Controller.
(G 735)

SOUTH EAST SCOTLAND ELECTRICITY BOARD

Lothians Sub-Area

APPLICATIONS are invited for the post of SECOND ASSISTANT ENGINEER (METERS) at Sub-Area Headquarters. Applicants, who should be Corporate Members of the Institution of Electrical Engineers or have passed the qualifying examination should have had wide experience in the operation of a Meter Test Department in an Electricity Supply Undertaking dealing with all classes of Meters and Metering Equipment.

Salary will be in accordance with the National Joint Board Agreement and will be Class "G," Grade 7, £651/£665/£679 per annum. The appointment will be superannuable and subject to a medical examination.

Applications stating age, education, qualifications and giving full details of experience should be addressed to Manager, South East Scotland Electricity Board, Lothians Sub-Area, Musselburgh, Midlothian to be received not later than December 22, 1950. (G 804)

SOUTH EAST SCOTLAND ELECTRICITY BOARD

Edinburgh Sub-Area

APPLICATIONS are invited to fill vacancies as JUNIOR ENGINEERS on the distribution staff of the Edinburgh Sub-Area. Applicants should have a sound general and technical education and preferably have had some experience in the electricity supply industry. The salary will be in accordance with the National Joint Board Agreement and within the range Grade "H" 17, £375/£387 to Grade "H" 14, £435/£451 per annum, depending upon qualifications and experience. The appointments are superannuable and subject to a satisfactory medical examination.

Applications, stating age, experience, qualifications and present post, should be received by the undersigned within 14 days after the appearance of this advertisement.

G. T. ALLCOCK,
Edinburgh Manager.

Dewar Place, Edinburgh 3. (G 732)

A FEW attractive vacancies for DRAUGHTSMEN exist at the Liverpool works of the English Electric Co. Ltd. The work is of electro mechanical nature, but any draughtsmen with experience on the design and detailing of mechanisms or welded fabrications or, in fact, any kind of medium mechanical equipment, will be considered. Excellent opportunities for advancement in this interesting field.—Please write, giving full details, mentioning reference 135A, to Central Personnel Services, English Electric Co. Ltd., 24/30 Gillingham Street, Westminster, S.W.1. (G 793)

ELECTRICAL DRAUGHTSMAN

ELECTRICAL DRAUGHTSMAN required by major oil company for service in the Middle East. Must have served five years electrical engineering apprenticeship and have had five years D.O. experience in connection with electrical layouts of large industrial plants with underground cable networks. Should possess Higher National Certificate. Graduate or Associate membership of a corporate engineering body desirable but not essential. Maximum age limit 35 years. Attractive salary plus generous allowance in local currency. Free passages out and home, free medical attention, kit allowance, good leave arrangements. Pension Scheme. Write, giving personal particulars and details of qualifications and experience, quoting:

DEPARTMENT F.192 TO BOX NO. 3095 AT 191 GRESHAM HOUSE, E.C.2.

Applicants without above requirements will not be considered. (G 717p)

DRAUGHTSMAN required (Walthamstow Area). Applicants must have served apprenticeship and have had good general experience. Good working conditions. Pension scheme.—Reply stating age, experience and salary required, to Box No. 1947, Electrical Times. (G 780)

DRAUGHTSMEN, electrical, required, capable of preparing complete cabling layouts for generating station. Willing to work any part of U.K.—Applicants should state experience, salary required and age to—Box No. 1957, Electrical Times. (G 785)

DRAUGHTSMEN. Britain's leading design consultants and contractors require urgently Senior Switchgear Draughtsmen, also Juniors to train as Switchgear Draughtsmen. Good salaries and prospects of advancement for suitable applicants. Pension scheme. —Write in confidence, quoting reference ET, to John A. Smith Ltd., 24 Lichfield Street, Wolverhampton. (G 714)

ELECTRICAL FOREMAN. The Steel Company of Wales Ltd., have a number of vacancies for Electrical Foremen (maintenance) at their Abbey, Margam and Port Talbot works. Apprenticeship and experience on maintenance of heavy industrial plant (preferably steelworks) is essential.

Applications giving full particulars of training and experience should be addressed to: The Superintendent (Labour and Wages), P.O. Box No. 9, Port Talbot, Glam. (G 775)

ELECTRICAL wholesalers in the Midlands offer permanent, progressive position to experienced, quick thinking young man of good personality for inside sales, quotations, etc.—Box No. 1953, Electrical Times. (G 783)

ENGINEERS, senior and junior, required for power cable installations, home and abroad. Should have knowledge of generating station cabling layouts. Applicants should state age, experience, salary expected to—Box No. 1955, Electrical Times. (G 784)

EXPERIENCED SENIOR DRAUGHTSMEN urgently required by a well-known manufacturer for employment in the Midland and London areas. Excellent opportunities for men experienced in switchgear layouts and design. These are senior vacancies carrying salaries of up to £600 per annum, and good possibilities exist for the provision of accommodation in the Midland area for suitable married applicants.—Write, giving full details of age, qualifications and previous experience, quoting Ref. ADA, to Box No. 1959, Electrical Times. (G 810)

IMPROVER DRAUGHTSMAN, age about 19-21, National Service completed or exempt, required for work associated with electrical engineering. Previous Drawing Office experience essential. Salary according to age.—Write for interview giving details of experience to The Assistant Secretary, The Micanite & Insulators Co., Ltd., Empire Works, Blackhorse Lane, E.17. (G 779)

JUNIOR CONTRACTS ENGINEERS required by prominent switchgear manufacturers. Appointments are in connection with export contract work, and offer an opportunity for eventual overseas service. Candidates should hold an Ordinary or Higher National Certificate in electrical engineering, and have had a recognised course of works training.—Applications, giving fullest details, should be addressed to the Personnel Manager, A. Reyrolle and Co. Ltd., Hebburn, Co. Durham. (G 759)

MANUFACTURERS of electrical cooking and heating equipment require DRAUGHTSMAN for industrial design and development work. Birmingham.—Reply, stating age, experience and salary, to Box No. 1951, Electrical Times. (G 782)

BOX No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London W.C.2

FERRANTI LIMITED require an energetic man to take charge of heavy engineering assembly shops. Candidates must have sound engineering experience, but above all must have proved qualities of leadership and drive. The position carries responsibility to the Works Manager and involves the supervision of Foremen. Salary will depend on experience and ability and a high figure will be paid to a suitable man. The Company has a staff pension scheme.—Application forms from the Staff Manager, Ferranti Limited, Hollinwood, Lancs. Please quote Reference T.S. (G 778)

QUALIFIED ELECTRICAL ENGINEER with experience in the design and development of servo and electromagnetic equipment for aircraft, will find interesting work and a progressive position in a rapidly expanding company.—Apply, stating age, details of experience and salary required, to Mr. G. Orloff, Chief Designer, British Messier Ltd., Cheltenham Road East, Gloucester. (G 608)

SENIOR CONTRACTS ENGINEERS required by prominent switchgear manufacturers. Appointments are in connection with export contract work, and offer an opportunity for eventual overseas service. Candidates should possess a degree, or equivalent in electrical engineering and have had some commercial experience.—Applications, giving fullest details, should be addressed to the Personnel Manager, A. Reyrolle and Co. Ltd., Hebburn, Co. Durham. (G 758)

TELEPHONE MECHANIC. A vacancy exists at a large works in Neath district, South Wales, for a Telephone Maintenance Mechanic experienced in the maintenance of Strowger type automatic exchange apparatus and associated equipment. Applicants must be capable of locating and repairing faults on overhead lines and multicore telephone cables and on subscribers' apparatus.—Apply to Box No. 1945, Electrical Times, stating age, experience, etc. Envelope to be marked "Telephone Mechanic". (G 771)

TEST ROOM require experienced man with some technical training for rotating electrical machines up to 6 kW. large variety of designs. South East London.—Box No. 1941, Electrical Times. (G 742)

TO meet an expanding programme applications are invited from SENIOR DRAUGHTSMEN for posts in the Switchgear Drawing Offices of the English Electric Co. Ltd., Stafford. Excellent opportunities exist for men having experience in any of the following :—Layout of indoor or outdoor switchgear, preparation of schematic and detail diagrams, mechanical design.—Apply giving full particulars of previous experience quoting reference 141 A to Central Personnel Services, English Electric Co. Ltd., 24/30 Gillingham Street, Westminster, S.W.1. (G 740)

APPOINTMENTS WANTED

EXPERIENCED ELECTRICIAN, age 28, seeks permanent progressive employment in South or South-West England.—Box No. 1923, Electrical Times. (G 702)

WORK WANTED

A.C. and d.c. Motor Rewinds and Repairs. Prompt service, fully guaranteed.—Edgware 8631 (4 lines). Service Electric Co., Ltd., Stanmore, Middx (D 324)

ARMATURE SERVICE CO., LTD., Haddington Street, Hove (Tel. 32996), electrical engineers and winding specialists. Distance no object. (F 739)

CASTINGS, Fisher Foundries, Ltd., Greet, Birmingham, have capacity for brass, gun metal and soft grey iron machine moulded repetition castings weighing 1-30 lb. Loose pattern work up to 3 cwt. Delivery by road to all parts. Tel.: B'ham, Victoria 0197 (F 270)

NOTE quality and prices of PROCESS TIMERS, PHOTO-ELECTRIC CONTROLS, RELAYS, etc. Manufactured by Electrical Remote Control Co. Ltd., of 13/15 Evanston Avenue, London E.4. LAR 5435. (G 807)

STANLEY L. LYONS, L.S.I.A., Registered Lighting Engineer (I.E.S.). Consulting illuminating engineer & designer. 97 Latchmere Road, S.W.11 (BAT. 5047). (G 797)

WANTED

A.C./D.C. MOTORS, STARTERS, complete change-over installations, etc.—A.A. Electrical Co., Ltd., 67 Rothschild Road, Chiswick Park, W.4. Phone: Chiswick 5105. (A 20)

COX & DANKS LTD. require all types of Modern ELECTRIC MOTORS, SWITCHGEAR AND ANCILLARY EQUIPMENT. Please send full details to Cox & Danks Ltd., Plant Department, Scapa House, Park Royal Road, N.W.10. Telephone: Elgar 5811. (G 627)

FRACTIONAL HORSE-POWER MOTORS. Advertisers with ample funds desire to purchase well established manufacturing concern.—Apply Box No. 1949, Electrical Times. (G 781)

REQUIRED. Offers of small portable ELECTRICAL BRONCHITIS KETTLES for hospital and sick room use.—Offers to Henry W. Bush and Co. Ltd., Waddon Factory Estate, Croydon. (G 776)

WANTED, ROTARY CONVERTERS, any size.—Universal, 221 City Road, London E.C.1. (A 16)

WANTED for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper, Ltd., 176 Brady Street, Bethnal Green, E.1. (A 1)

WANTED.—Large quantity of 4-in. outside diameter TUBES from the dismantling of old Babcock Water-tube Boilers. Best prices paid. Prepared to purchase Babcock and Wilcox Water-tube Boilers for dismantling. —Apply, giving full details, to Midland Iron and Hardware Co., Cradley Heath. (A 5)

WANTED, D.C. and A.C. ball-bearing MOTORS MOTOR GENERATOR SETS, DYNAMOS and ALTERNATORS.—Full details to Britannia Manufacturing Co., Ltd., 22-26 Britannia Walk, London N.1. (A 13)

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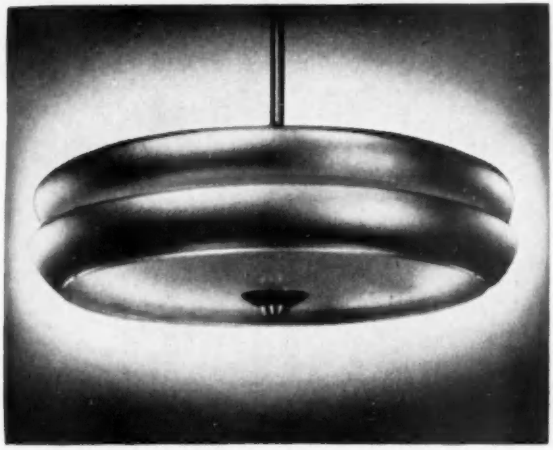

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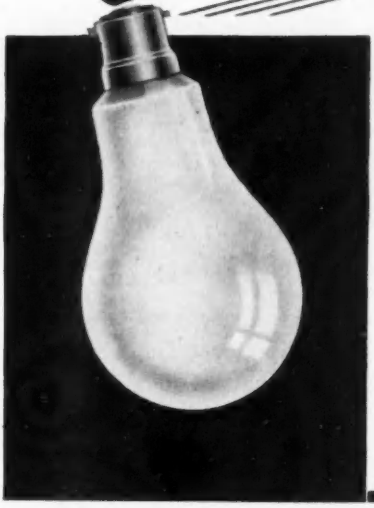

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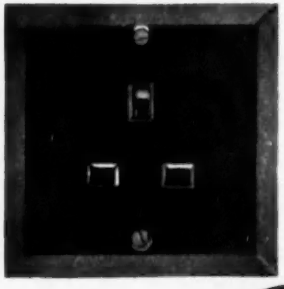

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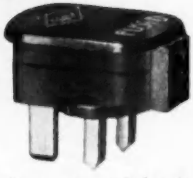

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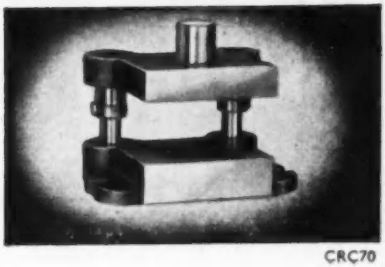

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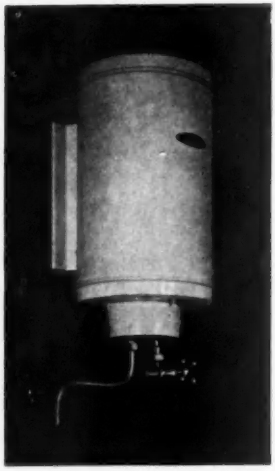

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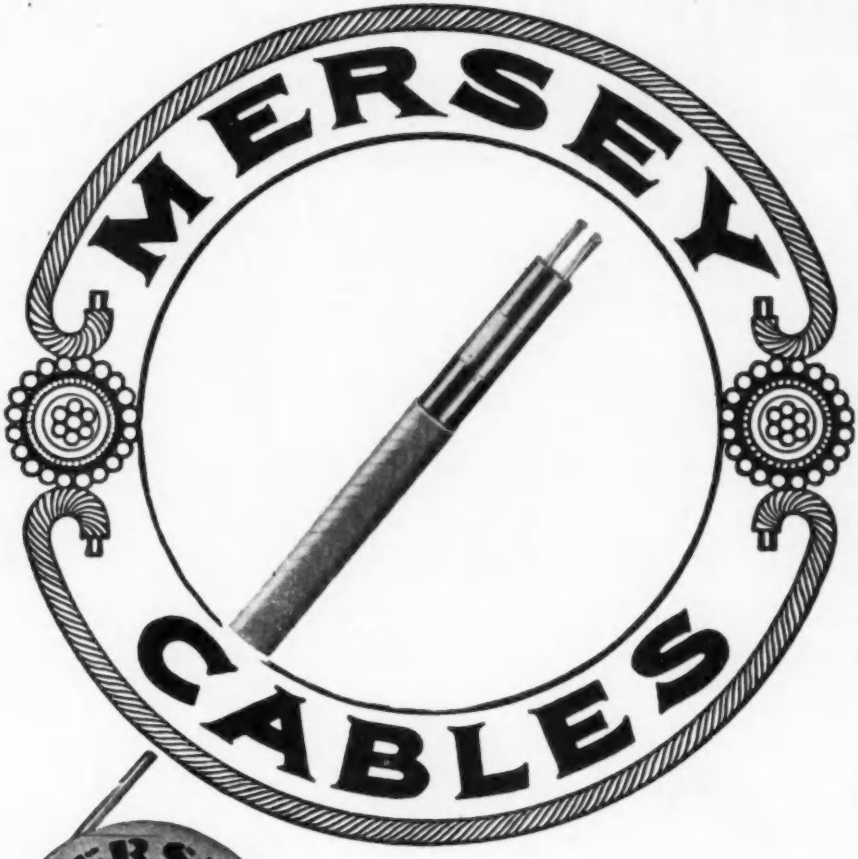

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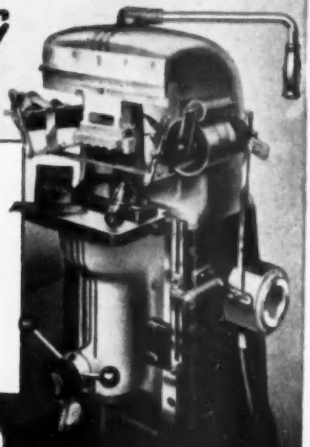

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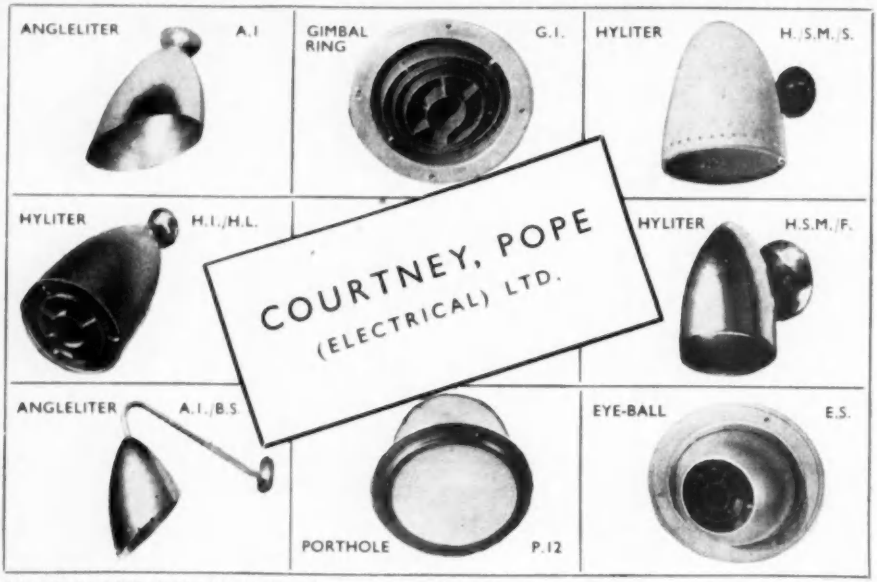

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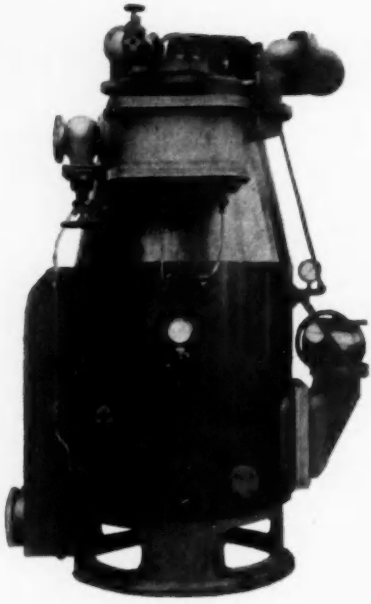

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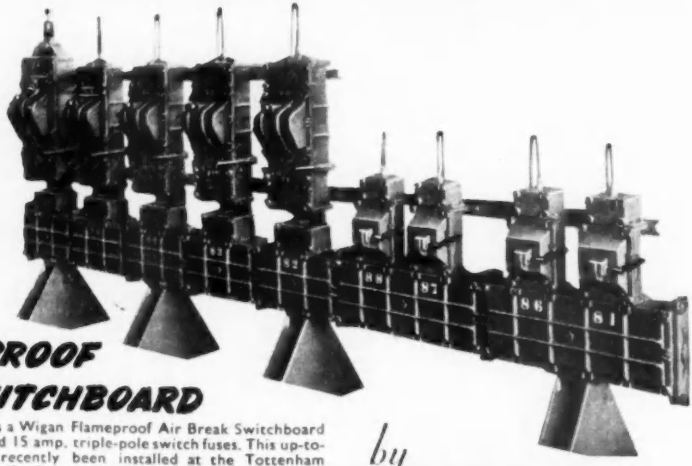

FLAMEPROOF SWITCHBOARD

The illustration shows a Wigan Flameproof Air Break Switchboard consisting of 60, 30 and 15 amp. triple-pole switch fuses. This up-to-date installation has recently been installed at the Tottenham Division of the Eastern Gas Board. Flameproof switchboards can be supplied in various combination and capacities up to 60 amp. T.P. and neutral under Buxton Certificates Groups I, II and III.

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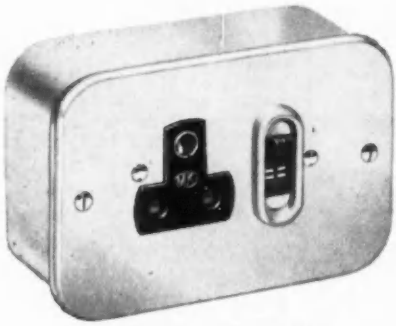

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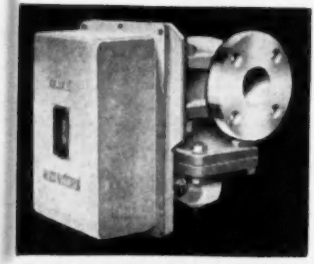

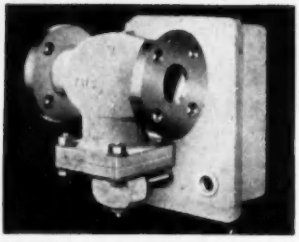

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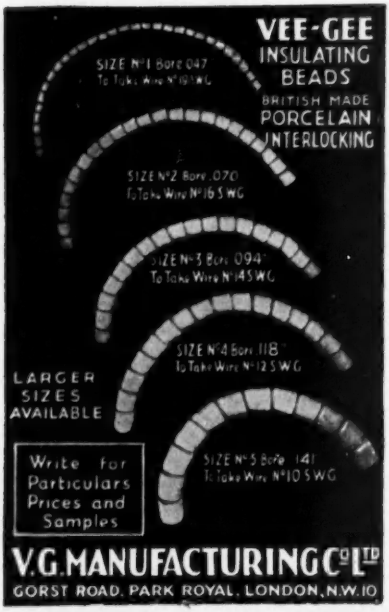

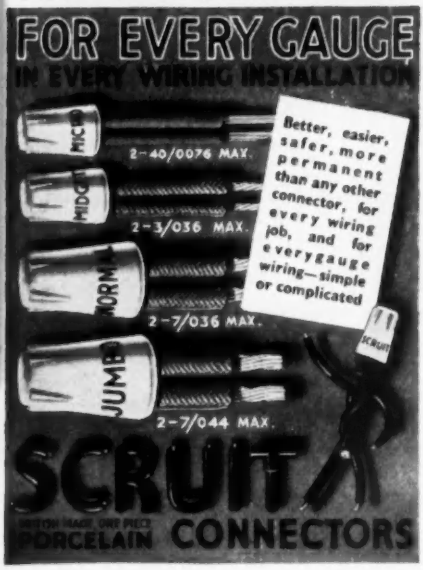

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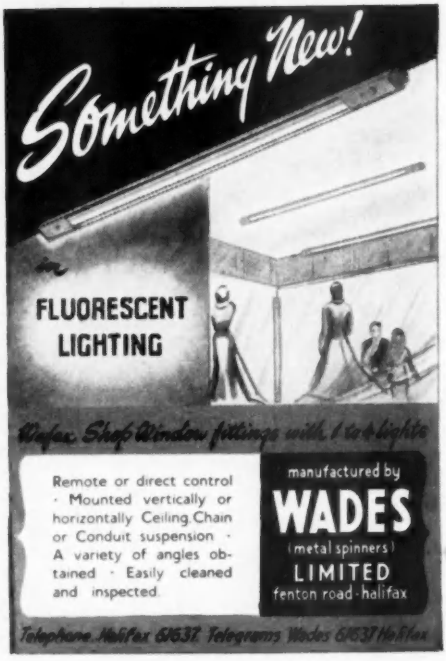
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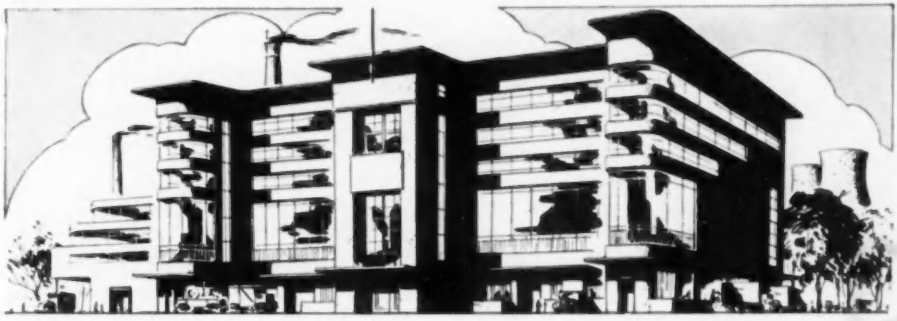

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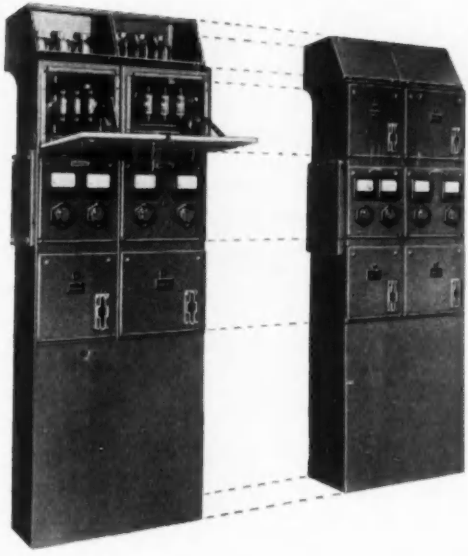

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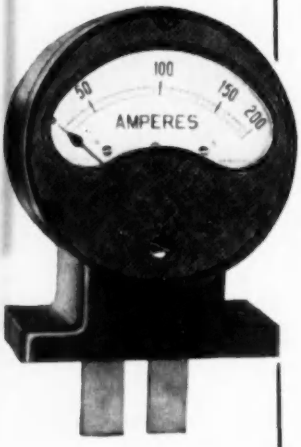

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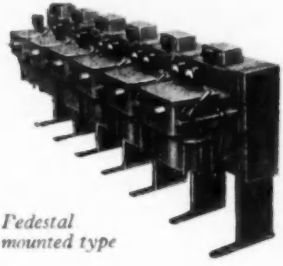
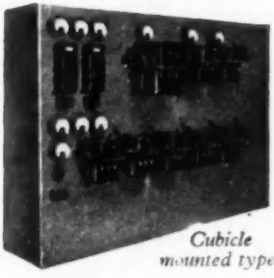


Pedestal mounted type



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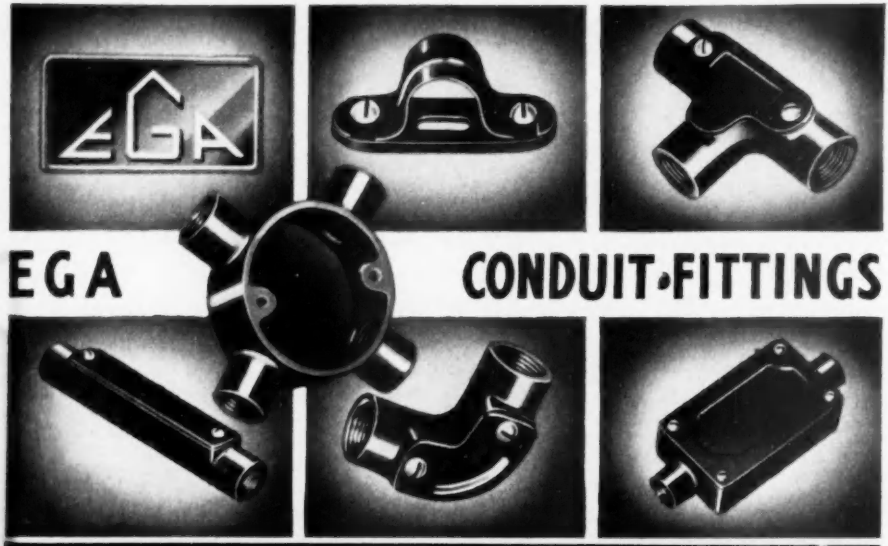

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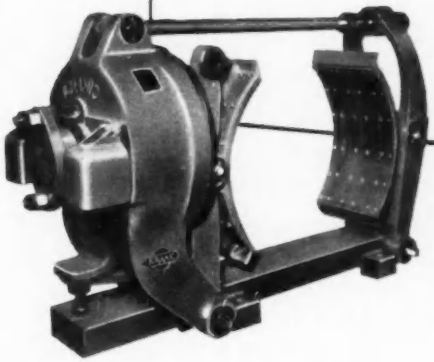

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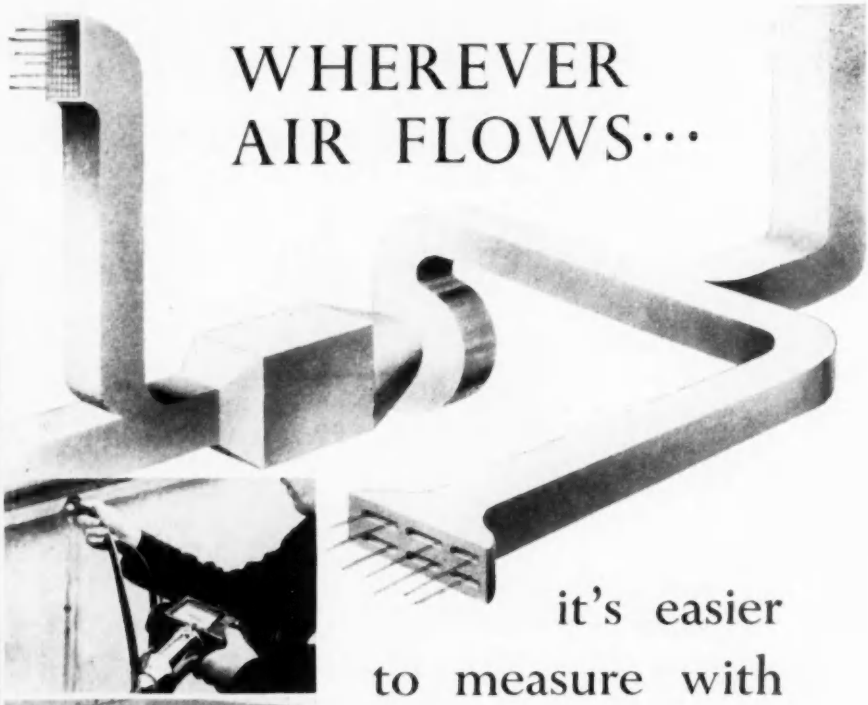

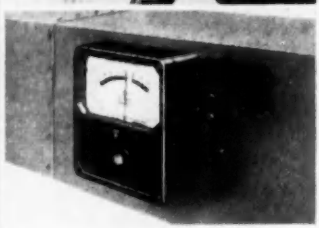

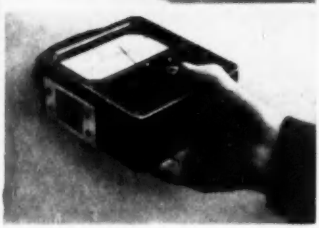

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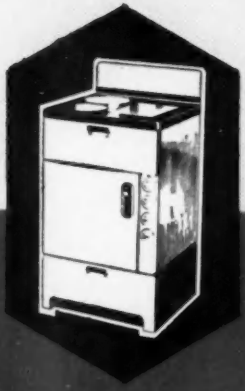

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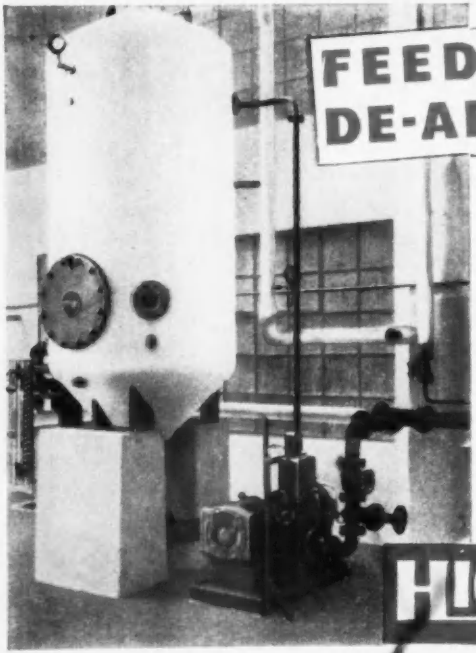

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